

AD-A081 832

TETRA TECH INC PASADENA CA
COMPUTER PROGRAMS FOR CALCULATING PARTIALLY CAVITATING BLUNT TR--ETC(U)
JAN 80 S MAEKAWA, O FURUYA
N00014-79-C-0234

F/G 9/2

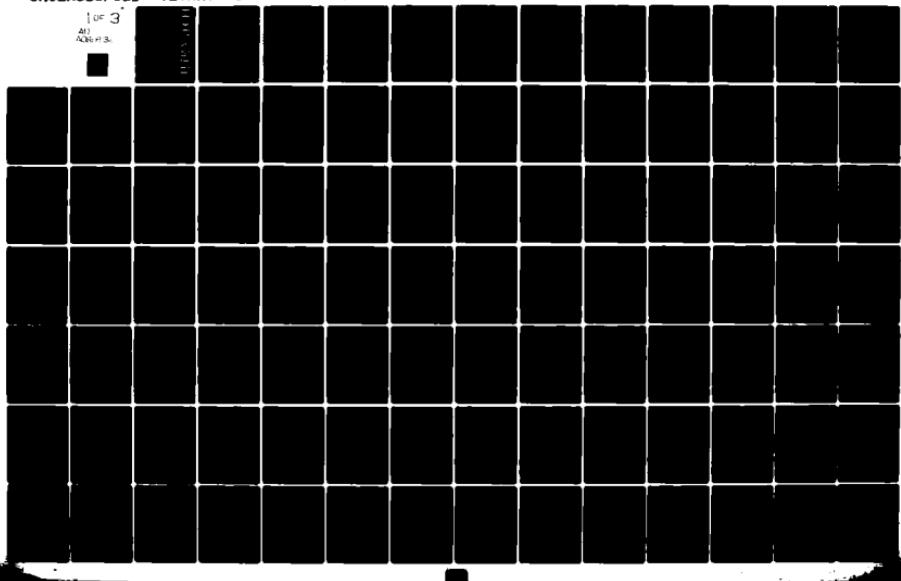
NL

UNCLASSIFIED

TETRAT-TC-3284-02

1 OF 3

AM
ADM H Sc



Report No. TC 3284-02
Contract No. N00014-79-C-0234 (GHR Program)

ADA 081832

COMPUTER PROGRAMS FOR CALCULATING PARTIALLY
CAVITATING BLUNT TRAILING EDGED CASCADE FLOWS
IN NONLINEAR THEORY

by

Shin Maekawa
Okitsugu Furuya

TETRA TECH, INC.
630 NORTH ROSEMEAD BOULEVARD
PASADENA, CALIFORNIA 91107

Prepared for

DAVID W. TAYLOR NAVAL SHIP RESEARCH
AND DEVELOPMENT CENTER
BETHESDA, MARYLAND 20084

OFFICE OF NAVAL RESEARCH
800 NORTH QUINCY STREET
ARLINGTON, VIRGINIA 22217

JANUARY 1980

Approved for public release;
distribution unlimited

THIS DOCUMENT IS BEST QUALITY PRACTICABLE.
COPY FURNISHED TO DDC CONTAINED A
SIGNIFICANT NUMBER OF PAGES WHICH DO NOT
PRODUCE LEGIBLY.

80 3 14 056

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DDC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

Report No. TC 3284-02
Contract No. N00014-79-C-0234 (GHR Program)

COMPUTER PROGRAMS FOR CALCULATING PARTIALLY
CAVITATING BLUNT TRAILING EDGED CASCADE FLOWS
IN NONLINEAR THEORY

by

Shin Maekawa
Okitsugu Furuya

TETRA TECH, INC.
630 NORTH ROSEMEAD BOULEVARD
PASADENA, CALIFORNIA 91107

Prepared for

DAVID W. TAYLOR NAVAL SHIP RESEARCH
AND DEVELOPMENT CENTER
BETHESDA, MARYLAND 20084

OFFICE OF NAVAL RESEARCH
800 NORTH QUINCY STREET
ARLINGTON, VIRGINIA 22217

JANUARY 1980

Approved for public release;
distribution unlimited

100% FILE COPY

This research was carried
out under the Naval Sea
Systems Command General
Hydromechanics Research
Program Subproject
SR 023 09 01, adminis-
tered by the David W.
Taylor Naval Ship
Research and Development
Center, Contract
N00014-79-C-0234.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER TC 3284-02	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Computer Programs for Calculating Partially Cavitating Blunt Trailing Edged Cascade Flows in Nonlinear Theory		5. TYPE OF REPORT & PERIOD COVERED Technical Manual for Program 15 Feb - Oct 1979
6. AUTHOR(s) Shin/Maekawa Okitsugu/Furuya		7. PERFORMING ORG. REPORT NUMBER TETRA Tech - TC 3284-02
8. PERFORMING ORGANIZATION NAME AND ADDRESS TETRA TECH, INC. 630 North Rosemead Blvd. Pasadena, CA 91107		9. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS DWTNSR&DC 9191967/10-30-78(1505)
10. CONTROLLING OFFICE NAME AND ADDRESS David W. Taylor Naval Ship R&D Center Department of the Navy Bethesda, Maryland 20084		11. REPORT DATE 11, January 1980
12. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Office of Naval Research 800 North Quincy Street Arlington, Virginia 22217		13. NUMBER OF PAGES 202
14. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		15. SECURITY CLASS. (of this report) Unclassified
16. DISTRIBUTION STATEMENT (of the abstract entered in Block 30, if different from Report)		17. DECLASSIFICATION/DOWNGRADING SCHEDULE
18. SUPPLEMENTARY NOTES Sponsored by the Naval Sea Systems Command General Hydrodynamic Research Program and administered by the David W. Taylor Naval Ship R&D Center, Code 1505, Bethesda, Maryland 20084.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Users' manual for computer programs Partial cavity flow Cascade Nonlinear theory Partially cavitating propeller		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) In addition to the previously developed partially cavitating cascade theory, two new flow models were constructed in search of a better flow model for determining accurate force coefficients. Effort has been made for obtaining (1) physically acceptable flows, particularly the location of cavity boundary and (2) smooth matching of the flow characteristics between the partially cavitating and supercavitating flow regimes. Based on the numerical results made with these flow models for practical blade profiles taken after a supercavitating propeller it was found that no single flow model developed above could handle the complete set of		

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. cascade geometries and incidence angles. One theory was supplemental to the other and no definite guideline was discovered for selection of an appropriate flow model for a specified flow condition to be solved except for a few weak evidences.

This report is a users' manual for the computer programs developed above, describing the structure of program, input data set-up, typical output data and listing.

UNCLASSIFIED

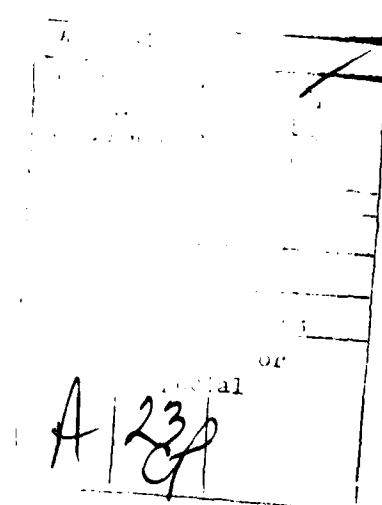
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

TABLE OF CONTENTS

	<u>Page</u>
<u>LIST OF FIGURES</u>	ii
1.0 <u>INTRODUCTION</u>	1
2.0 <u>STRUCTURE OF PCASE</u>	3
3.0 <u>INPUT DATA</u>	8
3.1 INPUT DATA FOR PCASE	9
3.2 INPUT DATA FOR PCASLE	14
3.3 INPUT DATA FOR PCASLDW	15
3.4 TYPICAL DATA SET-UP FOR PCASE	16
3.5 TYPICAL DATA SET-UP FOR PCASLE	17
3.6 TYPICAL DATA SET-UP FOR PCASLDW	18
4.0 <u>OUTPUT DATA</u>	19
4.1 TYPICAL OUTPUT DATA	21
5.0 <u>LISTING OF PCASE</u>	31
6.0 <u>LISTING OF PCASLE</u>	82
7.0 <u>LISTING OF PCASLDW</u>	136
8.0 <u>REFERENCES</u>	199

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Open Wake Model for PCASE and PCASLE	197
2	Double Wake Model for PCASLDW.	198



1.0

INTRODUCTION

Three computer programs were developed under the present work (see [1]). Two of these programs, PCASE and PCASLE, used the open wake models, whereas the third one, PCASLDW, used the double wake model of the partially cavitating cascade flow. PCASE requires the cavitation number, and PCASLE and PCASLDW require the cavity length as input data. The detailed explanations in regard to the type of model used for these programs are given in [1]. The general rule of thumb is that if the cavity length is short and/or the negative camber on the suction side of the cascade is small, PCASE converges rapidly, whereas if the cavity length becomes long and/or the negative camber on the suction side of the cascade is large, PCASLE provides a better convergence. PCASLDW may be used when the pressure-side camber is large so that the calculated cavity boundary tends to intersect the upper surface of the blade in the supercavitating cascade flow configuration.

Six solution parameters are to be determined for PCASE: these include three transform coordinates, scaling factor for mapping, deflected flow angle at downstream infinity, and ratio of flow passage width at downstream infinity to that at upstream infinity. For PCASLE, one extra solution parameter, i.e., cavitation number is added, making the total number of solution parameters seven. For PCASLDW, one of the solution parameters, i.e., ratio of flow passage at downstream infinity to upstream infinity, was deleted, but two new solution parameters, i.e., two transform coordinates, were introduced, making the total number of solution parameters eight. PCASLDW requires the most computer time of the three to carry out one iteration due to the increased total number of solution parameters.

In the following, the structure of the program including various subroutines, input data set-up, typical output data and

listings of these three programs is described. Due to the similarity in the input data set-up of the programs, only that of PCASE is given completely. It is believed that there will be no difficulty in running PCASLE and PCASLDW once one becomes familiar with PCASE.

2.0 STRUCTURE OF PCASE

PCASE consists of a main program and several subroutines, brief descriptions of which will be given as follows:

1) MAIN PROGRAM PCASE

- o Specify the dimensions for data.
- o Read input data.
- o Exercise Newton's iterative procedure.
- o Calculate lift and drag coefficients at the end of each iteration.
- o Calculate the cavity profile.

2) SUBROUTINE OXFNEW(X,STOL,M,I,DG,DF,FFF4)

- o Exercise Newton's iterative procedure in calculations for the six integral equations to find the six unknown solution parameters.

x: Input and output data in array SXSI(I)

- SXSI(1): ξ - coordinate for the point B of the foil.
- SXSI(2): ξ - coordinate for the point C.
- SXSI(3): ξ - coordinate for the point F.
- SXSI(4): λ , coefficient of the mapping function.
- SXSI(5): α_2' , downstream flow angle.
- SXSI(6): ϵ - ratio of d_2 to d_1

STOL: Control variables for the accuracy of Newton's iterations.

M: Number of desired iterations for Newton's procedure.

I: Counts the number of iterations of Newton's procedure.
This is defined within OXFNEW.

DG: This is one of the assigned finite differences for the numerical derivations of $\frac{\partial f}{\partial x}$. However, it is no longer used in the calculations themselves as it has been replaced by the array DELI(I,J) which is read in at the beginning of the program.

DF: Same as DG.

FFF4: The residue of equation F(4); if FFF4 becomes larger than S4 of input data, the program is stopped.

3) SUBROUTINE OFSIM1 (ANS,NOF,XCA)

- o Calculates integral I(1) of integral equation F(1) for special case of foil shape with rounded left end. Called from subroutines: FLINTL, RMINT, CAVITY (see Reference [1] for F(1)).

ANS: Final answer for the integral I(1) of equation F(1).

NOF: This is a controlling variable passed on from the calling subroutines:

NOF = 0 - OFSIM1 called from FLINTL
NOF = 1 - OFSIM1 called from RMINT for real part
NOF = 2 - OFSIM1 called from RMINT for imaginary part
NOF = 3 - OFSIM1 called from CAVITY OXFNEW at F(5)

XCA: Integration variable passed on to OFSIM1 only if NOF = 3.

4) SUBROUTINE OFSIM2 (ANS2)

- o Controls iterative procedure for calculating integral equation F(4). Called from OXFNEW (see Reference [1] for F(4)).

ANS2: Final answer of OFSIM2

5) SUBROUTINE OFSIM3 (Y,XXII,IP,I)

- o Calculates $g_1(\xi)$ in integral equation F(4). Called from OFSIM2. (see [1] for $g_1(\xi)$).

Y: Integration variable passed from OFSIM2, corresponding to ξ .

XXII: Returns value of $g_1(\xi)$ to OFSIM2. The parameter is passed from OFSIM2 to OFSIM3 in the form of one element of an array (XITC(I)) inside an iterative loop.

IP: Number referring to the control point; IP = 1 to LPM.

I: I = 2 for the subdivided middle point between the regular control points specified by IP; I = 3 for the control points.

6) SUBROUTINE OFSIM5 (ANS5)

- o Calculates values of F(5) using Simpson's rule and Chebyshev-Gauss polynomials.

ANS5: Value returned to loop in OXFNEW for equation F(5).

7) SUBROUTINE FLINTL (YINT, KCTRL)

- o Calculates integrals in integral equation F(1). Called from OXFNEW.

YINT: Value returned for integral each time FLINTL is called.

KCTRL: Control variable passed from OXFNEW directing which of the four integrals in F(1) is to be calculated. (see [1]).

8) SUBROUTINE G2(XS2,AG2,IS2)

- o Calculates $g_2(\xi)$ in F(5) given integral variable ξ , i.e., XS2. Called from iterative loop in OFSIM5.

XS2: Abscissa subdivision points from which $g_2(\xi)$ are calculated, i.e., ξ .

AG2: Value for $g_2(\xi)$ returned to OFSIM5 after each time it is called.

IS2: Number of control points on the second arc S2.

9) SUBROUTINE RMINT(SR,SM,MIQ)

- o Calculates $r_1, r_2, r_3, r_4; m_1, m_2, m_3, m_4$ of equations F(2) and F(3) respectively. These values are used to calculate F(2) and F(3) in OXFNEW (see [1]).

SR: Value for r returned to OXFNEW

SM: Value for m returned to OXFNEW

MIQ: Control variable passed from OXFNEW dictating which value (1, 2, 3 or 4) of r or m is to be calculated.

10) SUBROUTINE CAVITY (XCC, YCC)

- o Calculates coordinates of points along cavity cross-section to give cavity shape. Passes cavity endpoint coordinates back to OXFNEW.

XCC: Value returned to OXFNEW for x coordinate of cavity endpoint.

YCC: Value returned to OXFNEW for y coordinate of cavity endpoint.

11) SUBROUTINE IC2(SR,SM,XCA, ISIC)

- o When ISIC = 0 used to calculate r_4 and m_4 of equations F(2) and F(3) respectively. It is then called from OXFNEW. When ISIC = 1 it is used to calculate.

SR,SM: When called from RMINT this is the returned value for r_4 and m_4 . When called from CAVITY, only SR is used and SM becomes dummy (see Reference [1]).

XCA: Only used for ISIC = 1, integration variable.

ISIC: This is a control variable which tells IC2 whether to do calculation for OXFNEW or for OFSIM5 or CAVITY.

= 0 called from RMINT.

= 1 called from CAVITY IN OFSIM5 for F(5).

12) SUBROUTINE MOSEC (A,B,ER1,X,J,XLPA,IS1I2)

- o Finds a root of $f(x) = 0$ where x must lie between A and B and $f(A) > 0$, $f(B) < 0$.

A,B: A root of $f(x) = 0$ exists between A and B.

ER1,ER2: Accuracy controlling variables where
 $|x_{real} - x| < ER1$ and $|f(x_{real}) - f(x)| < ER2$.

x: A root of $f(x) = 0$, found in this subroutine and returned to the calling program.

J: Number of iterations done in MOSEC.

13) FUNCTION AITKEN(XX,YY,X,N)

- o Interpolate the value corresponding to X with the data of XX(N), YY(N) specified by Aitken method.

14) SUBROUTINE DETERM (A,N,D)

- o Calculates determinant of a matrix A of rank N

A: Matrix input, requiring dimension.

N: Rank of the matrix.

D: Calculated determinant of A.

15) SUBROUTINE ARCS2 (S2,XC,YC)

- o Calculates the arc length of the upper wetted portions S2. Called from OXFNEW in calculations for F(5) after the CAVITY subroutine.

S2: returned arc length of arc S2.

XC: X-coordinate of cavity endpoint.

YC: y-coordinate of cavity endpoint.

16) SUBROUTINE ARCLEN (XSS,XL,XH,IS1I2)

- o Calculates arc length of small intervals between XL and XH along foil profile.

XSS: Returned arc segment length.

XL: Lower x coordinate of segment endpoint.

XH: Upper x coordinate of segment endpoint.

IS1I2: Control variable telling the routine whether the upper or lower edge of the foil is to be looked at; IS1I2 = 0 for the lower edge, IS1I2 = 1 for the upper edge.

17) SUBROUTINE XCYC (XCB,YCB,CX,CY)

- o Calculates the point on the upper face of the foil corresponding to the endpoint of the cavity.

- XCB: X-coordinate of returned point on foil.
- YCB: Y-coordinate of returned point on foil.
- CX: X-coordinate of cavity endpoint.
- CY: Y-coordinate of cavity endpoint.
- 18) SUBROUTINE BBBETA (XX,RBETA, IS1I2)
- o Calculates BETA(X(XSI))
- XX: X-coordinate of the body for which the local body slope RBETA to be calculated.
- RBETA: Local body slope in radians calculated in this subroutine.
- IS1I2: Control variable; = 0 for the lower portion
- 19) SUBROUTINE FARC (FAR, XLPA,X1B,IS1I2)
- o Calculates the difference between the arc length DSS and that corresponding the ξ -coordinates of XLPA and X1B.
- IS1I2: The same as that in BBBETA.
- 20) SUBROUTINE SHAPE (X,Y,BETA,IS1I2)
- o Calculates points along cross-section of foil to give shape of foil. Also gives the angle of the tangent to the foil at each point.
- X: X-coordinate for which Y and BETA to be calculated.
- Y: Y-coordinate of calculated point.
- BETA: Angle of tangent to the foil at calculated point.
- IS1I2: Control variable to tell the subroutine whether to look at the upper or lower face of the foil.
- 21) SUBROUTINE FC2 (T,F,XL,XH,IS1I2)
- o Calculates values of the function along the wetted arc to be integrated in the subroutine ARCLEN.
- T: Value to be calculated at.
- F: Value of the function.
- XL: Low limit of the integration.
- XH: Upper limit of the integration.
- IS1I2: Control variable; = 1 for sharp leading edge
= 0 for round leading edge

3.0

INPUT DATA

The following data are those for the family program of PCAS (Partially Cavitating Cascade Cases) which include PCASE, PCASLE, and PCASLDW. Formatting examples are shown in Section 3.1. Several data cards must be changed in order to run the different version of PCAS.

It is important to note that these programs, particularly PCASLDW, were written to be able to handle blunt trailing edged foils properly. Readers are advised to see [3] for the cases having sharp trailing edges. The input data set-ups shown below are those for calculating the two-dimensional loadings for a partially cavitating propeller. The input parameters representing the propeller blade configurations include R, AAAA, to CCCC, A8 to D8 XROUND and A2AA to C2CC. The definition of these parameters is described in [1]. The thickness of the foil which was used for the plano-convex foil case in the previous project [1] is now a dummy input in these programs.

3.1 INPUT DATA FOR PCASE

DATA CARD NO.	SYMBOL	DESCRIPTION	FORMAT
1	NGAUS	Number of subdivisions used in Gaussian integration.	I10
2-4	TGAUS(I)	Abscissas of Gaussian integration.	4F20.10
5-7	WGAUS(I)	Weight factors of Gaussian integration.	4F20.10
8	XXM	Weighting factor for solution parameters in iterative procedure (0 to 1).	F10.8
9-14	DELT(I,J)	Increment for numerical calculations of partial derivatives.	6F10.8
15	TH	The thickness in percent of the plano-convex foil (dummy variable).	3F20.10
	XXDD	End of the normalized foil = 1.	
	YYDD	Y coordinate of upper end of the normalized foil.	
16	R	Specifies the radial location on the propeller blade (normalized to be unity at the tip)	4F20.10
	AAAA,BBBB,CCCC	Coefficients for terms in the equation of the cross-sectional shape of the lower face of the propeller blade. These coefficients are used in the second equation for x values along the cross-section where .2 < x < .8 (see Reference 2 for the form of equation).	

17	A8,B8,C8,D8	Coefficients for third equation of cross-sectional shape of the lower face of the blade where $x \leq .8$ (see [2] for the form of equation).	4F20.10
18	XROUND	Leading edge radius. This is actually used only when ISHARP = 1 (rounded leading edge). Otherwise it is a dummy variable.	4F20.10
	A2AA,B2BB,C2CC	Coefficients for first equation of cross-sectional shape of the lower face of the blade where $x \leq .2$ (see [2] for the form of equation).	
19	AAAAU,BBBBU,CCCCU	Coefficients for second equation of cross-sectional shape of the upper face of the blade where $.2 \leq x \leq .8$ (see [2] for the form of equation).	4F20.10
20	A8U,B8U,C8U,D8U	Coefficients for third equation of cross-sectional shape of the upper face of blade where $x \geq .8$ (see [2] for the form of the equation).	4F20.10
21	A2AAU,B2BBU,C2CCU	Coefficients for first equation of cross-sectional shape of the upper face of blade where $x \leq .2$ (see [2] for the form of the equation).	4F20.10
22	IFLAG1	= 0 - for regular runs ≠ 0 - for runs reading data from CASCLIM. Needs extra data for SXSI(2), SXSI(3).	2I10
	NCHBY	The number of Chebyshev-Gauss control points.	
23	SBETA	Initial angle of incidence for a starting flat plate solution in degrees.	5E14.7
	SBETA2	Body angle of a flat plate in degrees. Used as an initial solution.	

	SF4	Always set = 10. Used to stop computation if the calculated arc length S1 becomes larger than SF4.	
	BETAB	Body angle at point B.	
	BETAC	Body angle at point C. (initially assumed value)	6I8
24	LPMS	Number of control points over the ξ coordinates between $\xi = -1$ and b. Used for first arc length S1. (see Reference [1]).	
	LPKS	Number of subdivisions between $\xi = b$ and the last point of the coarse division made by LPMS.	
	LPM2	Same as LPMS only used for calculations on second arc length S2. Note that there is only 1 segment spacing here.	
	IFLAG	= 1 - for first run which requires data to be fed in, i.e., but only SXSI(1) to SXSI(5).	
		= 0 - for use of previous data in which case data will be read either from a data card (if IREAD = 5) or from tape (if IREAD = 1). For IREAD = 5, not only SXSI(1) to SXSI(5) but also SARC(I), BETAN(I): SARC2(I), BETA2 must be read from the data card.	
	IREAD	Used for controlling where data is read from. Either tape or card as above.	
	ISHARP	= 0 - for sharp leading edge. = 1 - for rounded leading edge.	
25	NITER	Number of flow configurations to be calculated in 1 run.	4I8

	MSTOP	Number of iterations to stop the larger nest.	
	MAXIT	Number of iterations for Newton's loop.	
	NHK	Control index for varying either the set values of the angle of incidence, solidity, or cavitation number, depending on 1, 2, or 3, respectively for the NITER loop.	
26	ALFA1S	Flow incidence angle in degrees (see Figure 1).	4E14.7
	GAMMAS	Cascade geometric stagger angle in degrees (see Figure 1)	
	SOLIS	Solidity of the cascade (= c/s in Figure 1)	
	SIGMS	Cavitation number = $(p_1 - p_c) / \frac{1}{2} \rho V_1^2$	
27	DE,DG,DF	Finite differences for numerical derivations of $\frac{\partial f}{\partial x}$ in subroutine OXFNEW. These are replaced by DELT(I,J), no longer used.	3E14.7
28	SXSI(I), I = 1,6	This card is necessary only if IFLAG = 1; SXSI(I), I = 1,6 correspond to b, c, f, A, α_2 , and ϵ . Values for SXSI(I) must be arbitrarily assumed and tried to see if a convergent solution is obtained.	6E13.6
29	SARC(1), BETAN(1)	Arc length vs. local incidence angle in radians for the lower portion of the body; these data are needed only if IFLAG = 0 and IREAD = 5.	2E14.7
	?		
29 + LPM	SARC(LPM), BETAN(LPM)		

30 + LPM
 SARC2(1) BETAN2(1)
 ,
 30 + LPM + LPM2
 SARC2(LPM2) BETAN2(LPM2)

Arc length vs. local incidence angle in radians for the upper portion of the body; these data are needed only if IFLAG = 0 and IREAD = 5.

3.2 INPUT DATA FOR PCASLE

Several input cards change from those of PCASE. Only the changes are noted here.

DATA CARD NO.	SYMBOL	DESCRIPTION	FORMAT
9-14	DELT(I,J)	Increment for numerical calculations for partial derivatives.	7F10.8
26	ALFA1S	Flow incidence angle in degrees (see Figure 1).	4E14.7
	GAMMAS	Cascade geometric stagger angle in degrees (see Figure 1).	
	SOI IS	Solidity of the cascade (= σ /s in Figure 1).	
	CAVLEN	Specified cavity length (= l_c in Figure 1).	
28	SXSI(I), I = 1, 7	This card is necessary only if IFLAG = 1; SXSI(I), I = 1, 7 correspond to b, c, f, A, α_2 , σ , and ϵ .	7F10.7

3.3 INPUT DATA FOR PCASLDW

Several input cards change from those of PCASE. Only the changes are noted here.

DATA CARD NO.	SYMBOL	DESCRIPTION	FORMAT
9-15	DELT(I,J)	Increment for numerical calculations for partial derivatives.	8F10.8
26	ALFALS	Flow incidence angle in degrees (see Figure 2).	4E14.7
	GAMMAS	Cascade geometric stagger angle in degrees (see Figure 2).	
	SOLIS	Solidity of the cascade (= c/s in Figure 2).	
	CAVLEN	Specified cavity length (= l_c in Figure 2).	
28	SXSI(I), I=1,8	This card is necessary only if IFLAG = 1; SXSI(I), I = 1, 8 correspond to b, c, f, \tilde{A} , α_2 , σ , g, and h.	8F10.7

3.4

TYPICAL DATA SET-UP FOR PCASE

```

PCASCA,PT,T100,CM120000,304833,MACKAWA
FETCHPS,PCASCH,_G0,PRCP,
FETCHPS,PCASCA,TAPE1,PC017,
_G0,
ENTERPS,PCASCA,TAPE7,PC017,
REWIND,TAPE7,
COPYSOF,TAPET,CUTPUT,
20
  .0766265211    .2277958611    .3737060867    .5108670 2
  .6360536807    .7463319065    .8381165718    .812234283
  .9639719273    .9931265392
  .1527533571    .1491723363    .1420961093    .1316888384
  .1131943320    .1019321193    .0932767415    .0826727463
  .0406014295    .0176140071

0.7
  .00000001    .00000001    .00000001    .00000001    .00000001
  .00000001    .00000001    .00000001    .00000001    .00000001
  .00000001    .00000001    .00000001    .00000001    .00000001
  .00000001    .00000001    .00000001    .00000001    .00000001
  .00000001    .00000001    .00000001    .00000001    .00000001
  .00000001    .00000001    .00000001    .00000001    .00000001
  0.
  1.          0.
  0.5
  0.0155502    -0.0669965    0.0054452
  0.1345763    -0.5573011    0.5723851    -0.3152717
  0.600312     -0.3223314    -0.0136034    -0.0807203
  0.035542      0.021325     0.325911
  0.1952432     -0.2705562     0.814421    -0.1733240
  0.1636552     -0.5333767     0.3526387

  0.
  0.          -100.        10.        -100.        -100.
  71   30       40           1
  1   1       4           1
  0.          53.63       435       0.9
  1.E-7      1.E-3       1.E-5

```

3.5 TYPICAL DATA SET-UP FOR PCASLE

PCASCL7, P7, T200, C4120300, 334633, MAEKA,A
FETC173, PCASL7, 33, PC_L7,
FETC17S, PCASL7, TAPE1, PL004.
33,
ENKRPSS, PCASL7, TAPE7, PL004.
RE41ND, TAPE7,
COPYSE, TAPE7, QJTPUF.

20
 •0765265211 .2277853511 .3737960987 .51056702
 •5360535807 .7453319065 .88391169718 .9122344263
 •9539719273 .9931225592
 •1527533871 .1431729365 .1420951093 .1319586384
 •1131946323 .1819301193 .0832757415 .1525720463
 •0405014295 .0176143771
 3.7
 •00000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 •10000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 •00000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 •00000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 •00000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 •00000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 •00000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 •00000001 .00000001 .00000001 .00000001 .00000001 .00000001 .00000001
 0.
 1.
 0.
 3.5 0.01193 -0.0602553 -0.0041395
 3.1034857 -0.4542559 0.5306437 -0.2476161
 3.1101955 -0.0553112 0.1579029 -0.3673004
 3.110331 .0343799 .0372023
 -0.039177 .2145351 -.1862176 .0511030
 .1531716 -.5395237 1.0509821
 40
 0. -130. 10. -130. -180.
 71 30 40 1
 i 1 5 1
 4. 43.33 .535 .35
 1.0E-7 1.0E-3 1.0E-5
 .000000026 .02656057 .06225021 .032733555 -.0549531 .151000000 .3570967

3.6 TYPICAL DATA SET-UP FOR PCASLDW

```

PCAS=9,P7,T300,C4220000,539302,MAEKAWA
#TCHPS,PCAS=9,-30,PC=9.
#TCHPS,PCASC=9,TAPE1,PW033.
33.
ENTERPS,PCASC=9,TAPE7,PW009.
REINVJ,TAPE7.
COPYSBF,TAPE7,OJTPUT.
CKIT.
EKKI.
DJM2,0.
#IN.
#LES,L=ZZTAP.
#TCHPS,DFM,DFM,DFM.
CA,,DFM.

```

**

20							
	.0765265211	.2277858511	.3737060987	.5109670 2			
	.6360536807	.7463319063	.8391169718	.9122344283			
	.9539719273	.9931255992					
	.1527533571	.1491729365	.1420961093	.1315586384			
	.1131945320	.1019301195	.0932757415	.0625720483			
	.0406014293	.0176140071					
0.7							
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001	.00000001 .00000001			
0.5							
	.01545753	.01533502	-0.0669965	.0.0054482			
	.01545753	-0.5573011	0.5723851	-0.3152717			
	.0100312	-0.0223314	-0.0138032	-0.0807203			
	.01335642	.0021305	.0328911				
	.0335433	-.2703552	.3818481	-.1733240			
	.0136632	-.5339753	.3526987				
40							
	0.	-130.	10.	-130.	-180.		
	71 30	40	1				
	1 3	4					
	2.	53.63					
	1.E-7	1.E-3	.485				
			1.E-5				
1.03				.98			

**

4.0

OUTPUT DATA

Most of the output are self-explanatory, however, those not explained in output data are described as follows:

- T(I): This is just a repetition of the input data TGAUS(I).
- W(I): Repetition of input data WGAUS(I).
- X(I): Solution parameters corresponding to SXSI(I). Each time these appear they are an updated version of those preceding them.
- CAV(X): This gives the x-coordinate of the cavity endpoint.
- CAV(Y): This gives the y-coordinate of the cavity endpoint.
- P(I,J): Partial derivatives of Function F(I) used for Newton's method.
- YINT4: Solution to 4th integral of equation F(l).
- SOLNR & SOLNM: Intermediate calculated values of integrals, only used for checking the numerical accuracy.
- F(X): Residue of each function F(1)...F(8)
- SXSI(I): Solutions.
- CLINF: Lift coefficient at infinity.
- CDINF: Drag coefficient at infinity.
- CCDD: Drag coefficient.
- CCLL: Lift coefficient.
- L_D : Cavity length to chord ratio.
- BIGS2: Arc length of the face of the foil. Either upper or lower face.
- XCCC: x-coordinate of cavity endpoint.
- YCCC: y-coordinate of cavity endpoint.

XS2D: Intermediate values used as a check for progress of program. Can be ignored.

XKSI: Intermediate values used as a check for progress of program. Can be ignored.

XXX2: x-coordinate distance from the leading edge.

SARC2: Distance from the leading edge along the upper surface of foil at XXX2.

CP2: Normalized pressure at the upper surface of foil at XXX2.

BBTAN2: Slope of the upper surface of the foil surface at XXX2.

XXX: x-coordinate distance from the leading edge.

SARC: Distance from the leading edge along the lower surface of foil at XXX.

CP: Normalized pressure at the lower surface of foil at XXX.

BETAN: Slope of the lower surface of the foil at XXX.

4.1 TYPICAL OUTPUT DATA

LEAD MAP
BLOCK ASSIGNMENTS

LINKE = EKY 5286/7099 8-4

20 JUL 79 16:06:47

```

X AND Y COORDINATES OF UPPER BLADE END POINT=(1.040000, .04053
THICKNESS OF PLATE CONVEX FCIL = 0. XXM= .73000
BETA3 AND BETA2 AS FIRST GUESS=-180.00000 -180.00000
R= .5* AAAA= .011931 68B= -.060255 CCCC= -.004140
AF= .113487 68= -.454256 CP= .530844 0*= -.247618
XROUND= .0099297 A2AA= -.065811 82B= .0157909 C2CC= -.367300
AAAAJ= .007073 68B3= .004380 CCCCJ= .037292
ABU= -.013915 88U= .214535 CSU= -.186218 CSU= .051103
AAAU= .165171 3233U= -.6679524 C2CCU= 1. 60982
AAAU= .165171 3233U= -.6679524 C2CCU= 1. 60982
P4= 71 LPK= 30 SBETA= 0. IREAD=1 NCH3Y= 46
DE= .1700711E-16 CG= .1700711E-12DF= .1900000E-04 SF= .1000000E+02
SBET12= .01160001E+03
LPM2= 81 ISHARP= 1
INCIDE.CE ANGLE= .537317E+01 GAMMA= .4988000E+02 SOLIDITY= .5e52030E+00
F_LAP ANGLE= 0.
CAVITY_NG= .6571300E+00
CR3U= .113487E+01 UPPER SEP. POINTS= 7. CCNN POINT(xC,yC)=( 0.
XXCC= 1.040000 YYCC= .140573
TIDS= .0131751E+01
ITERATIO_NG= 2
X(1)= .1824693E-02
X(2)= .7137411E-01
X(3)= .0133657E-01
X(4)= .1347936E-01
X(5)= -.7132451E-01
X(6)= .9155941E+00
    1= 0BTAN2= -.3173587E+01 YKSI= .7137740E-01
    2= 0BTAN2= -.3153767E+01 XKSI= .7190378E-01
    3= 0BTAN2= -.3154141E+01 XKSII= .7195636E-01

```

I= 4	S8TA1'2=	-3134457E+01	XKSI=	.7293484E-01	
I= 5	S8TA1'2=	-31175419E+01	XKSI=	.7213672E+01	
I= 6	S8TA1'2=	-3116235E+01	XKSI=	.7226736E-01	
I= 7	S8TA1'2=	-3116195E+01	XKSI=	.7241997E-01	
I= 8	S8TA1'2=	-3116745E+01	XKSI=	.7259561E-01	
I= 9	S8TA1'2=	-31138164E+01	VKSI=	.7279320E-01	
I= 10	S8TA1'2=	-3115654E+01	XKSI=	.7301152E-01	
I= 11	S8TA1'2=	-31136146E+01	XKSI=	.7324922E-01	
I= 12	S8TA1'2=	-3113712E+01	XKSI=	.7350408E-01	
I= 13	S8TA1'2=	-3113395E+01	XKSI=	.7377679E-01	
I= 14	S8TA1'2=	-3114009E+01	VKSI=	.7406341E-01	
I= 15	S8TA1'2=	-3114033E+01	XKSI=	.7436293E-01	
I= 16	S8TA1'2=	-3114124E+01	XKSI=	.7467350E-01	
I= 17	S8TA1'2=	-3114162E+01	XKSI=	.7499321E-01	
I= 18	S8TA1'2=	-3114234E+01	XKSI=	.7532036E-01	
I= 19	S8TA1'2=	-31142417E+01	VKSI=	.7565210E-01	
I= 20	S8TA1'2=	-3114277E+01	XKSI=	.7598722E-01	
I= 21	S8TA1'2=	-31143123E+01	XKSI=	.7632338E-01	
I= 22	S8TA1'2=	-31143854E+01	XKSI=	.7655850E-01	
I= 23	S8TA1'2=	-31143755E+01	VKSI=	.7699052E-01	
I= 24	S8TA1'2=	-31144033E+01	VKSI=	.7731739E-01	
I= 25	S8TA1'2=	-31144304E+01	XKSI=	.7763710E-01	
I= 26	S8TA1'2=	-31144605E+01	XKSI=	.77947567E-01	
I= 27	S8TA1'2=	-31144951E+01	XKSI=	.7824719E-01	
I= 28	S8TA1'2=	-3114577E+01	VKSI=	.7853381E-01	
I= 29	S8TA1'2=	-31145255E+01	XKSI=	.7890577E-01	
I= 30	S8TA1'2=	-31145475E+01	VKSI=	.7906139E-01	
I= 31	S8TA1'2=	-31145551E+01	XKSI=	.7929968E-01	
I= 32	S8TA1'2=	-31145505E+01	XKSI=	.7951740E-01	
I= 33	S8TA1'2=	-31145544E+01	XKSI=	.7953389E-01	
I= 34	S8TA1'2=	-31146153E+01	VKSI=	.7989063E-01	
I= 35	S8TA1'2=	-31146155E+01	XKSI=	.8004324E-01	
I= 36	S8TA1'2=	-31146235E+01	XKSI=	.8017100E-01	
I= 37	S8TA1'2=	-31146317E+01	XKSI=	.8027576E-01	
I= 38	S8TA1'2=	-31146365E+01	VKSI=	.8035284E-01	
I= 39	S8TA1'2=	-31146412E+01	XKSI=	.8040682E-01	
I= 40	S8TA1'2=	-31146413E+01	XKSI=	.8043320E-01	
ACEV0D=	.858595E+00	S2=	.14214E+00	YUPPER=	.40352E-01
ACEV0C=	.858586E+00	S2=	.14214E+00	YUPPER=	.40352E-01
ACEV0S=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
CEIV0D=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
CEIV0C=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
CEIV0S=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV0D=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV0C=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV0S=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV1D=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV1C=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV1S=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV2D=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV2C=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
YCEV2S=	.858589E+00	S2=	.14214E+00	YUPPER=	.40352E-01
(I,J)=	.1553251E+02	+.27459544E+00	.27459544E+00	0.	-8532453E+00
(I,J)=	.1553134E+02	.2125635E+01	-.7615647E+00	-.8897173E+01	.5119634E+00
(I,J)=	-.1553335E+02	.19193455E+01	-.6897224E+00	-.1042817E+01	.2497401E+00
(I,J)=	-.1522852E+02	.3397492E+00	-.3386625E+00	.1207028E+02	.9914400E+00
(I,J)=	.4579417E+02	.52363145E+01	-.1059146E+02	.1369444E+02	.1091612E+01
(I,J)=	.14721787E+03	.31751675E+01	-.1971079E+01	-.7924601E+01	.1326221E-01
B15S2=	.14214	CCCC=	.85889	YCCC=	.84057
CAVX=	0.	CAVY=	0.		
CAVX=	.000103	CAVY=	.00195		
CAVX=	.00091	CAVY=	.00251		
CAVX=	.00281	CAVY=	.00477		
CAVX=	.00599	CAVY=	.00759		
CAVX=	.01160	CAVY=	.01096		
CAVX=	.01715	CAVY=	.01459		
CAVX=	.022571	CAVY=	.01337		
CAVX=	.02763	CAVY=	.02491		
CAVX=	.03239	CAVY=	.02399		
CAVX=	.04717	CAVY=	.03507		
CAVX=	.04723	CAVY=	.04260		
CAVX=	.01129	CAVY=	.00946		
CAVX=	.01755	CAVY=	.00551		
CAVX=	.01655	CAVY=	.00560		
CAVX=	.02212	CAVY=	.00751		
CAVX=	.023811	CAVY=	.00707		
CAVX=	.02755	CAVY=	.00910		
CAVX=	.031461	CAVY=	.00844		
CAVX=	.035364	CAVY=	.00902		
CAVX=	.039226	CAVY=	.00977		
CAVX=	.043111	CAVY=	.00969		
CAVX=	.046644	CAVY=	.01010		
CAVX=	.051131	CAVY=	.01317		
CAVX=	.063448	CAVY=	.010382		
CAVX=	.066590	CAVY=	.010384		


```

P(I,J)= .2642131E+02   -6356349E+00   -2786797E+00   0.   -4529348E+00   -1615669E+00
P(I,J)= .1534244E+03   .2143736E+01   -.7744611E+01   -.8912556E+01   .5117232E+00   -5621826E+03
P(I,J)= -.4165350E+02   .1932657E+01   -.6292396E+00   -.1044348E+01   .2491757E+00   -2739654E+00
P(I,J)= -.7263513E+02   .2974679E+00   -.3445613E+00   .1208924E+02   .9932863E+00   -1091230E+01
P(I,J)= .4576756E+02   .3252611E+01   -.1666485E+02   .1373571E+02   .1211292E+01   -1533733E-01
P(I,J)= .1472277E+03   .32166239E+01   -.2029455E+01   -.7932231E+01   .7156913E+00   -7862634E+00
SIGS2= .14193  XLCCZ= .65910  YCCCZ= .0+036

CAVX= 0.   CAVY= .
CAVX= .00008  CAVY= .00085
CAVX= .07091  CAVY= .00252
CAVX= .00281  CAVY= .01479
CAVX= .00899  CAVY= .03760
CAVX= .01069  CAVY= .01097
CAVX= .01717  CAVY= .01469
CAVX= .02774  CAVY= .01539
CAVX= .03672  CAVY= .02442
CAVX= .04545  CAVY= .03300
CAVX= .06724  CAVY= .03609
CAVX= .08735  CAVY= .04451
CAVX= .11102  CAVY= .04747
CAVX= .17521  CAVY= .05553
CAVX= .15576  CAVY= .05361
CAVX= .21233  CAVY= .07552
CAVX= .23355  CAVY= .07737
CAVX= .27613  CAVY= .08109
CAVX= .31491  CAVY= .08342
CAVX= .35395  CAVY= .09298
CAVX= .39260  CAVY= .09572
CAVX= .43033  CAVY= .09963
CAVX= .46676  CAVY= .10173
CAVX= .51163  CAVY= .10378
CAVX= .53460  CAVY= .10372
CAVX= .56621  CAVY= .10373
CAVX= .59537  CAVY= .10315
CAVX= .60381  CAVY= .10205
CAVX= .65711  CAVY= .10346
CAVX= .67485  CAVY= .09343
CAVX= .69513  CAVY= .09597
CAVX= .72703  CAVY= .09311
CAVX= .74764  CAVY= .08395
CAVX= .76174  CAVY= .08513
CAVX= .77523  CAVY= .08206
CAVX= .79542  CAVY= .07749
CAVX= .81146  CAVY= .07232
CAVX= .82635  CAVY= .06541
CAVX= .83773  CAVY= .06343
CAVX= .85151  CAVY= .05561
CAVX= .85910  CAVY= .04436

F(1)= .21971 .7E+05
F(2)= -.15319 .7E+05
F(3)= -.13143 .217E+05
F(4)= -.211235E+05
F(5)= .37157312E+05
F(6)= -.42179177E+05
X(1)= .1327436E+02
X(2)= .716513E+01
X(3)= .51113E+01
X(4)= .33444E+01
X(5)= .7145999E+01
X(6)= .9179448E+01

ITERATION .0.= 2

X(1)= .1523454E+02
X(2)= .716513E+01
X(3)= .51113E+01
X(4)= .33444E+01
X(5)= .7145999E+01
X(6)= .9179448E+01

Iz 1  BBTAN2= -.3133581E+01  XKSI= .7138526E-01
Iz 2  BBTAN2= -.3133757E+01  XKSI= .7197904E-01
Iz 3  BBTAN2= -.3134148E+01  XKSI= .7193044E-01
Iz 4  BBTAN2= -.3134597E+01  XKSI= .7200715E-01
Iz 5  BBTAN2= -.3135019E+01  XKSI= .7210269E-01
Iz 6  BBTAN2= -.31352295E+01  XKSI= .7223444E-01
Iz 7  BBTAN2= -.3136213E+01  XKSI= .7238362E-01
Iz 8  BBTAN2= -.3137497E+01  XKSI= .7255531E-01
Iz 9  BBTAN2= -.3138554E+01  XKSI= .7274846E-01
Iz 10 BBTAN2= -.3138554E+01  XKSI= .7296187E-01
Iz 11 BBTAN2= -.3139344E+01  XKSI= .7319422E-01
Iz 12 BBTAN2= -.3139312E+01  XKSI= .7344409E-01
Iz 13 BBTAN2= -.3139963E+01  XKSI= .7379993E-01
Iz 14 BBTAN2= -.3140303E+01  XKSI= .7399011E-01
Iz 15 BBTAN2= -.3140334E+01  XKSI= .7428289E-01
Iz 16 BBTAN2= -.3140124E+01  XKSI= .7458647E-01
Iz 17 BBTAN2= -.3141552E+01  XKSI= .7489399E-01
Iz 18 BBTAN2= -.3142435E+01  XKSI= .7521851E-01

```

```

it 19 85TA12= -.314+24172E+01 XKSIZ= .75543C6E-01
it 20 85TA12= -.314+27775E+01 XKSIZ= .7587064E-01
it 21 85TA12= -.314+31232E+01 XKSIZ= .7619924E-01
it 22 85TA12= -.314+34562E+01 XKSIZ= .7652683E-01
it 23 85TA12= -.314+37555E+01 XKSIZ= .7685138E-01
it 24 85TA12= -.314+40635E+01 XKSIZ= .7717690E-01
it 25 85TA12= -.314+43642E+01 XKSIZ= .7740341E-01
it 26 85TA12= -.314+46705E+01 XKSIZ= .777870CE-01
it 27 85TA12= -.314+49512E+01 XKSIZ= .7807978E-01
it 28 85TA12= -.314+52577E+01 XKSIZ= .7935996E-01
it 29 85TA12= -.314+55245E+01 XKSIZ= .7962580E-01
it 30 85TA12= -.314+57860E+01 XKSIZ= .7987557E-01
it 31 85TA12= -.314+60512E+01 XKSIZ= .7917602E-01
it 32 85TA12= -.314+63255E+01 XKSIZ= .7932143E-01
it 33 85TA12= -.314+65942E+01 XKSIZ= .7951457E-01
it 34 85TA12= -.314+68617E+01 XKSIZ= .7968626E-01
it 35 85TA12= -.314+71362E+01 XKSIZ= .7983544E-01
it 36 85TA12= -.314+74225E+01 XKSIZ= .7996119E-01
it 37 85TA12= -.314+6317E+01 XKSIZ= .8006273E-01
it 38 85TA12= -.314+5369E+01 XKSIZ= .8013944E-01
it 39 85TA12= -.314+45472E+01 XKSIZ= .8019085E-01
it 40 85TA12= -.314+46415E+01 XKSIZ= .8021663E-01

ACE112= +.59375E+10 S2= .14165E+01 YUPPER= .40355E-01
ACE112= +.59375E+00 S2= .14165E+01 YUPPER= .40355E-01
ACE112= +.59375E+01 S2= .14165E+00 YUPPER= .40355E-01
YCE112= +.59375E+10 S2= .14165E+01 YUPPER= .40355E-01
YCE112= +.59375E+00 S2= .14165E+01 YUPPER= .40355E-01
YCE112= +.59375E+01 S2= .14165E+00 YUPPER= .40355E-01
XCE112= +.59375E+10 S2= .14165E+01 YUPPER= .40355E-01
XCE112= +.59375E+00 S2= .14165E+01 YUPPER= .40355E-01
XCE112= +.59375E+01 S2= .14165E+00 YUPPER= .40355E-01
(XCE112= +.59375E+00 S2= .14165E+01 YUPPER= .40355E-01
(XCE112= +.59375E+01 S2= .14165E+00 YUPPER= .40355E-01
(XCE112= +.59375E+00 S2= .14165E+01 YUPPER= .40355E-01
ACE112= +.59375E+01 S2= .14165E+00 YUPPER= .40355E-01
ACE112= +.59375E+01 S2= .14165E+01 YUPPER= .40355E-01
ACE112= +.59375E+00 S2= .14165E+01 YUPPER= .40355E-01
ACE112= +.59375E+01 S2= .14165E+00 YUPPER= .40355E-01
(1,j)= +.2342651E+12 -.9973926E+01 .2799757E+00 0. -8528401E+00 -.1616584E+00
(1,j)= +.1553134E+03 -.2417637E+1 .7782130E+00 -.8914212E+01 .5113321E+00 -.5617097E+00
(1,j)= -.157569E+12 .1539479E+1 -.6231763E+00 .1742636E+01 .2490537E+00 -.2735910E+00
(1,j)= -.7244943E+02 .42255373E+00 .34633074E+00 .1209359E+02 .9933269E+00 -.1091132E+01
(1,j)= +.5735560E+02 .52314516E+01 .1757857E+02 .1374004E+02 .1174417E+01 -.1290137E+01
(1,j)= +.1717175E+03 .3229123E+01 -.211222E+01 -.7934355E+01 .7150947E+00 -.7855474E+00
S1632= .14165E+00 YCCC= .85935 YCCC= .40355
CAVX= 0. CAVY= 0.
CAVX= .30266 CAVY= .00065
CAVX= .01191 CAVY= .00252
CAVX= .11281 CAVY= .13479
CAVX= .30349 CAVY= .27760
CAVX= .01172 CAVY= .01592
CAVX= .01719 CAVY= .01490
CAVX= .02577 CAVY= .01139
CAVX= .03577 CAVY= .00244
CAVX= .05751 CAVY= .03003
CAVX= .05773 CAVY= .03612
CAVX= .07749 CAVY= .04265
CAVX= .11117 CAVY= .04952
CAVX= .13238 CAVY= .05568
CAVX= .16697 CAVY= .06366
CAVX= .20256 CAVY= .07058
CAVX= .23463 CAVY= .07713
CAVX= .27544 CAVY= .08314
CAVX= .31524 CAVY= .08946
CAVX= .35423 CAVY= .09323
CAVX= .39495 CAVY= .10576
CAVX= .43569 CAVY= .09967
CAVX= .46712 CAVY= .10177
CAVX= .50227 CAVY= .10311
CAVX= .53516 CAVY= .10374
CAVX= .56657 CAVY= .10375
CAVX= .60621 CAVY= .10317
CAVX= .64245 CAVY= .10208
CAVX= .67544 CAVY= .10047
CAVX= .67517 CAVY= .10343
CAVX= .69544 CAVY= .09597
CAVX= .72234 CAVY= .09311
CAVX= .74694 CAVY= .09385
CAVX= .76335 CAVY= .09518
CAVX= .77856 CAVY= .08207
CAVX= .79569 CAVY= .07740
CAVX= .81173 CAVY= .07232
CAVX= .84003 CAVY= .06640
CAVX= .84727 CAVY= .05942
CAVX= .85176 CAVY= .05060
CAVX= .85935 CAVY= .04036

```

$\text{f(1)} = .4944315E-07$
 $\text{f(2)} = -.1117475E-13$
 $\text{f(3)} = -e^{c25717E-17}$
 $\text{f(4)} = -.713311eE-04$
 $\text{f(5)} = .1157357E-13$
 $\text{f(6)} = -e^{i3e6be7E-13}$
 $\text{x(1)} = .1323576E-12$
 $\text{x(2)} = .7133415E-01$
 $\text{x(3)} = e^{i21794E-01}$
 $\text{x(4)} = .3344155E-01$
 $\text{x(5)} = -.7131974E-01$
 $\text{x(6)} = e^{i713215E-00}$
 $\text{SxSI}(1) = .1323573E-02$
 $\text{SxSI}(2) = .7133415E-01$
 $\text{SxSI}(3) = e^{i21794E-01}$
 $\text{SxSI}(4) = .3344155E-01$
 $\text{SxSI}(5) = -.7131974E-01$
 $\text{SxSI}(6) = e^{i713215E-00}$
 $I = 71 \text{ SARCE} = .$ XXX = CP = -0.5000000E+00 BETAN = -0.6571643E-01
 $I = 70 \text{ SARCE} = .5727181E-03$ XXX = .5714679E-03 CP = .9790812E+00 BETAN = -0.6553708E-01
 $I = 59 \text{ SARCE} = .1999761E-02$ XXX = .1496559E-02 CP = .3952424E+00 BETAN = -0.6524828E-01
 $I = 58 \text{ SARCE} = .2674e31E-02$ XXX = .2658333E-02 CP = .3631730E+00 BETAN = -0.6488494E-01
 $I = 57 \text{ SARCE} = .4054572E-02$ XXX = .4045599E-02 CP = .3333438E+00 BETAN = -0.6446200E-01
 $I = 56 \text{ SARCE} = .6511234E-02$ XXX = .5578453E-02 CP = .3992332E+00 BETAN = -0.6399016E-01
 $I = 55 \text{ SARCE} = .7319151E-02$ XXX = .7313901E-02 CP = .6757779E+00 BETAN = -0.6347788E-01
 $I = 54 \text{ SARCE} = .6152499E-02$ XXX = .3144057E-02 CP = .3556978E+00 BETAN = -0.6293226E-01
 $I = 53 \text{ SARCE} = .1126335E-01$ XXX = .1143357E-01 CP = .4124407E+00 BETAN = -0.6335939E-01
 $I = 52 \text{ SARCE} = .1319591E-01$ XXX = .1315914E-01 CP = .7935683E+00 BETAN = -0.6176459E-01
 $I = 51 \text{ SARCE} = .1536059E-01$ XXX = .1532923E-01 CP = .7656824E+00 BETAN = -0.6115254E-01
 $I = 50 \text{ SARCE} = .1760664E-01$ XXX = .1757363E-01 CP = .7459054E+00 BETAN = -0.6052741E-01
 $I = 39 \text{ SARCE} = .1993251E-01$ XXX = .1969331E-01 CP = .7236515E+00 BETAN = -0.59892E9E-01
 $I = 38 \text{ SARCE} = .2232363E-01$ XXX = .2226017E-01 CP = .7118591E+00 BETAN = -0.5925228E-01
 $I = 37 \text{ SARCE} = .247746FE-01$ XXX = .2472697E-01 CP = .6936359E+00 BETAN = -0.5860851E-01
 $I = 36 \text{ SARCE} = .2737915E-01$ XXX = .2722715E-01 CP = .6320217E+00 BETAN = -0.5756422E-01
 $I = 35 \text{ SARCE} = .2953116E-01$ XXX = .2947749E-01 CP = .6687759E+00 BETAN = -0.5732176E-01
 $I = 34 \text{ SARCE} = .3242553E-01$ XXX = .3238495E-01 CP = .6553332E+00 BETAN = -0.5668322E-01
 $I = 33 \text{ SARCE} = .355693E-01$ XXX = .3492927E-01 CP = .6447970E+00 BETAN = -0.5605046E-01
 $I = 32 \text{ SARCE} = .377218E-01$ XXX = .3756276E-01 CP = .6340239E+00 BETAN = -0.5542516E-01
 $I = 51 \text{ SARCE} = .4041504E-01$ XXX = .4134223E-01 CP = .6239429E+00 BETAN = -0.5480880E-01
 $I = 50 \text{ SARCE} = .4313399E-01$ XXX = .4305713E-01 CP = .6144950E+00 BETAN = -0.5420266E-01
 $I = 49 \text{ SARCE} = .4657501E-01$ XXX = .4657341E-01 CP = .6056252E+00 BETAN = -0.5360798E-01
 $I = 48 \text{ SARCE} = .4863509E-01$ XXX = .4855034E-01 CP = .5972866E+00 BETAN = -0.5302571E-01
 $I = 47 \text{ SARCE} = .5141150E-01$ XXX = .5132239E-01 CP = .5894362E+00 BETAN = -0.5245680E-01
 $I = 46 \text{ SARCE} = .5423171E-01$ XXX = .5411530E-01 CP = .5520316E+00 BETAN = -0.5190203E-01
 $I = 45 \text{ SARCE} = .5716344E-01$ XXX = .5659073E-01 CP = .5750536E+00 BETAN = -0.5136209E-01
 $I = 44 \text{ SARCE} = .5951458E-01$ XXX = .5971479E-01 CP = .5634566E+00 BETAN = -0.5083759E-01
 $I = 43 \text{ SARCE} = .6253322E-01$ XXX = .6252931E-01 CP = .5622173E+00 BETAN = -0.5032904E-01
 $I = 42 \text{ SARCE} = .6545766E-01$ XXX = .6535065E-01 CP = .5551113E+00 BETAN = -0.4983690E-01
 $I = 41 \text{ SARCE} = .6828611E-01$ XXX = .6817566E-01 CP = .5557150E+00 BETAN = -0.4936153E-01
 $I = 40 \text{ SARCE} = .7111172E-01$ XXX = .7101345E-01 CP = .5454608E+00 BETAN = -0.4890325E-01
 $I = 39 \text{ SARCE} = .7294978E-01$ XXX = .7133254E-01 CP = .5423715E+00 BETAN = -0.4846223E-01
 $I = 38 \text{ SARCE} = .7678227E-01$ XXX = .7666179E-01 CP = .5355874E+00 BETAN = -0.4803596E-01
 $I = 37 \text{ SARCE} = .7961374E-01$ XXX = .7849917E-01 CP = .5310402E+00 BETAN = -0.4763322E-01
 $I = 36 \text{ SARCE} = .8216431E-01$ XXX = .82131618E-01 CP = .5267153E+00 BETAN = -0.4724553E-01
 $I = 35 \text{ SARCE} = .8525479E-01$ XXX = .8513933E-01 CP = .5225982E+00 BETAN = -0.4687567E-01
 $I = 34 \text{ SARCE} = .8829177E-01$ XXX = .8795364E-01 CP = .5136766E+00 BETAN = -0.4652380E-01
 $I = 33 \text{ SARCE} = .9098940E-01$ XXX = .9077325E-01 CP = .5149397E+00 BETAN = -0.4618994E-01
 $I = 32 \text{ SARCE} = .9372157E-01$ XXX = .9358244E-01 CP = .5113761E+00 BETAN = -0.4587408E-01
 $I = 31 \text{ SARCE} = .96552761E-01$ XXX = .9638554E-01 CP = .5079755E+00 BETAN = -0.4557620E-01
 $I = 30 \text{ SARCE} = .9922658E-01$ XXX = .9918189E-01 CP = .5046885E+00 BETAN = -0.4529624E-01
 $I = 29 \text{ SARCE} = .24747693E-01$ XXX = .2474522E+00 CP = .5041331E+00 BETAN = -0.4682966E-01
 $I = 28 \text{ SARCE} = .29951101E-01$ XXX = .29851101E-01 CP = .4996955E+00 BETAN = -0.5015210E-01
 $I = 27 \text{ SARCE} = .3317593E-01$ XXX = .3314484E-01 CP = .3968519E+00 BETAN = -0.5354716E-01
 $I = 26 \text{ SARCE} = .4218386E-01$ XXX = .42124472E+00 CP = .389181902E+00 BETAN = -0.5671953E-01
 $I = 25 \text{ SARCE} = .4737292E-01$ XXX = .4733022E+00 CP = .3839676E+00 BETAN = -0.5962840E-01
 $I = 24 \text{ SARCE} = .5193522E-01$ XXX = .5139044E+00 CP = .3801824E+00 BETAN = -0.6229032E-01
 $I = 23 \text{ SARCE} = .56006101E-01$ XXX = .5595734E+00 CP = .3772525E+00 BETAN = -0.6473325E-01
 $I = 22 \text{ SARCE} = .5947727E-01$ XXX = .5952557E+00 CP = .3749057E+00 BETAN = -0.6698714E-01
 $I = 21 \text{ SARCE} = .6301196E-01$ XXX = .6296574E+00 CP = .3729680E+00 BETAN = -0.6907514E-01
 $I = 20 \text{ SARCE} = .6678719E-01$ XXX = .6663039E+00 CP = .3713497E+00 BETAN = -0.7101898E-01
 $I = 19 \text{ SARCE} = .69592123E-01$ XXX = .6956268E+00 CP = .3699955E+00 BETAN = -0.7283652E-01
 $I = 18 \text{ SARCE} = .7155442E-01$ XXX = .7149333E+00 CP = .3688844E+00 BETAN = -0.7454270E-01
 $I = 17 \text{ SARCE} = .7613952E-01$ XXX = .73951225E+00 CP = .3680244E+00 BETAN = -0.7615020E-01
 $I = 16 \text{ SARCE} = .7632293E-01$ XXX = .7625514E+00 CP = .3674592E+00 BETAN = -0.7766980E-01
 $I = 15 \text{ SARCE} = .7849377E-01$ XXX = .7842720E+00 CP = .3673949E+00 BETAN = -0.7911082E-01
 $I = 14 \text{ SARCE} = .8054814E-01$ XXX = .8047857E+00 CP = .3598157E+00 BETAN = -0.8079078E-01
 $I = 13 \text{ SARCE} = .8246474E-01$ XXX = .8242129E+00 CP = .3590786E+00 BETAN = -0.8364473E-01
 $I = 12 \text{ SARCE} = .8435136E-01$ XXX = .8426349E+00 CP = .3593959E+00 BETAN = -0.8668276E-01
 $I = 11 \text{ SARCE} = .8611813E-01$ XXX = .8602831E+00 CP = .3692383E+00 BETAN = -0.9043366E-01
 $I = 10 \text{ SARCE} = .8731495E-01$ XXX = .8776736E+00 CP = .3625664E+00 BETAN = -0.9424602E-01
 $I = 9 \text{ SARCE} = .8941e01E-01$ XXX = .8931354E+00 CP = .3673532E+00 BETAN = -0.9827576E-01
 $I = 8 \text{ SARCE} = .9396261E-01$ XXX = .9395740E+00 CP = .36854655E+00 BETAN = -0.1024650E+00

```

1= 1 SARCF= .924454e+01 XXXX= .9232313e+00 CP= .3529195E+00 BETAN= -.1066408E+01
1= 2 SARCF= .9756452E+01 XXXX= .937357E+00 CP= .3594371E+00 BETAN= -.1113140E+00
1= 3 SARCF= .9522921E+01 XXXX= .9579166E+00 CP= .3551950E+00 BETAN= -.1158726E+00
1= 4 SARCF= .9558494E+00 XXXX= .9639375E+00 CP= .3494019E+00 BETAN= -.1205109E+00
1= 5 SARCF= .9731191E+01 XXXX= .9764465E+00 CP= .3446695E+00 BETAN= -.1251897E+00
1= 2 SWCF= .9921156E+01 XXXX= .9994561E+00 CP= .3330276E+00 BETAN= -.1298915E+00
1= 1 SARCF= .9101697E+01 XXXX= .9999286E+00 CP= .2973646E+00 BETAN= -.1345742E+00
1= 1 SARCF= .9999999E+00 XXXX= .9999986E+00 CP= -.5000000E+00 BETAN2= -.3133894E+01
1= 2 SARCF2= .1421339E+01 XXXX= .8775563E+00 CP2= .988379E+00 BETAN2= -.3135412E+01
1= 3 SARCF2= .2843616E+01 XXXX= .8877942E+00 CP2= .9563735E+00 BETAN2= -.3136488E+01
1= 4 SARCF2= .3527614E+01 XXXX= .8966224E+00 CP2= .9131595E+00 BETAN2= -.3137546E+01
1= 5 SARCF2= .4211257E+01 XXXX= .9014606E+00 CP2= .8735149E+00 BETAN2= -.3138210E+01
1= 6 SARCF2= .4633340E+01 XXXX= .9102863E+00 CP2= .8377476E+00 BETAN2= -.3138669E+01
1= 7 SARCF2= .5173413E+01 XXXX= .9111128E+00 CP2= .8042569E+00 BETAN2= -.3139122E+01
1= 8 SARCF2= .5573779E+01 XXXX= .9151417E+00 CP2= .7735480E+00 BETAN2= -.3139955E+01
1= 9 SARCF2= .5931344E+01 XXXX= .9191712E+00 CP2= .746_198E+00 BETAN2= -.3139862E+01
1= 10 SARCF2= .6342531E+01 XXXX= .9227538E+00 CP2= .7204749E+00 BETAN2= -.3140155E+01
1= 11 SARCF2= .6876635E+01 XXXX= .9251362E+00 CP2= .6965324E+00 BETAN2= -.3140564E+01
1= 12 SARCF2= .7327301E+01 XXXX= .9296239E+00 CP2= .6751436E+00 BETAN2= -.3140792E+01
1= 13 SARCF2= .7356354E+01 XXXX= .9329115E+00 CP2= .6549034E+00 BETAN2= -.3141078E+01
1= 14 SARCF2= .7653766E+01 XXXX= .9359555E+00 CP2= .6363365E+00 BETAN2= -.3141342E+01
1= 15 SARCF2= .79711163E+01 XXXX= .9395959E+00 CP2= .6187795E+00 BETAN2= -.3141603E+01
1= 16 SARCF2= .8262397E+01 XXXX= .941968FE+00 CP2= .6018066E+00 BETAN2= -.3141648E+01
1= 17 SARCF2= .8533127E+01 XXXX= .9448781E+00 CP2= .5861888E+00 BETAN2= -.3142390E+01
1= 18 SARCF2= .8433575E+01 XXXX= .9476546E+00 CP2= .5714329E+00 BETAN2= -.3142318E+01
1= 19 SARCF2= .9115323E+01 XXXX= .9504311E+00 CP2= .5574493E+00 BETAN2= -.3142545E+01
1= 20 SARCF2= .9374634E+01 XXXX= .9531966E+00 CP2= .5441630E+00 BETAN2= -.3142759E+01
1= 21 SARCF2= .9641466E+01 XXXX= .9557625E+00 CP2= .5314563E+00 BETAN2= -.3142972E+01
1= 22 SARCF2= .9979553E+01 XXXX= .9583533E+00 CP2= .5193996E+00 BETAN2= -.3143175E+01
1= 23 SARCF2= .1015563E+01 XXXX= .9609042E+00 CP2= .5077887E+00 BETAN2= -.3143376E+01
1= 24 SARCF2= .1041442E+01 XXXX= .9613920E+00 CP2= .4966341E+00 BETAN2= -.3143569E+01
1= 25 SARCF2= .113320E+01 XXXX= .9656799E+00 CP2= .4653688E+00 BETAN2= -.3143750E+01
1= 26 SARCF2= .1374559E+01 XXXX= .9682937E+00 CP2= .4754665E+00 BETAN2= -.3143943E+01
1= 27 SARCF2= .1111397E+01 XXXX= .9727075E+00 CP2= .4654002E+00 BETAN2= -.3144124E+01
1= 28 SARCF2= .1117746E+01 XXXX= .9735054E+00 CP2= .4558383E+00 BETAN2= -.3144299E+01
1= 29 SARCF2= .1151633E+01 XXXX= .9754012E+00 CP2= .4459942E+00 BETAN2= -.3144472E+01
1= 30 SARCF2= .1133385E+01 XXXX= .9776853E+00 CP2= .4385848E+00 BETAN2= -.3144639E+01
1= 31 SARCF2= .1273237E+01 XXXX= .9799715E+00 CP2= .4273105E+00 BETAN2= -.3144604E+01
1= 32 SARCF2= .14223512E+01 XXXX= .9821990E+00 CP2= .4181231E+00 BETAN2= -.3144964E+01
1= 33 SARCF2= .1237753E+01 XXXX= .9844266E+00 CP2= .4085579E+00 BETAN2= -.3145122E+01
1= 34 SARCF2= .1272516E+01 XXXX= .9665994E+00 CP2= .3997447E+00 BETAN2= -.3145274E+01
1= 35 SARCF2= .12376244E+01 XXXX= .99887722E+00 CP2= .3903921E+00 BETAN2= -.3145425E+01
1= 36 SARCF2= .1315439E+01 XXXX= .9958915E+00 CP2= .3607741E+00 BETAN2= -.3145572E+01
1= 37 SARCF2= .13335345E+01 XXXX= .9936111E+00 CP2= .3707023E+00 BETAN2= -.3145716E+01
1= 38 SARCF2= .1357757E+01 XXXX= .9950763E+00 CP2= .3595658E+00 BETAN2= -.3145856E+01
1= 39 SARCF2= .1377939E+01 XXXX= .9971416E+00 CP2= .3476594E+00 BETAN2= -.3145954E+01
1= 40 SARCF2= .1377938E+01 XXXX= .9991414E+00 CP2= .3325091E+00 BETAN2= -.3146127E+01
1= 41 SARCF2= .1417936E+00 XXXX= .1021141E+01 CP2= .2973646E+00 BETAN2= -.3146259E+01
CLIVF OF COINFFORCE/1/2824W1NF** CLIVF= .9545285E+00 CCINF= .2017576E-01
FINF IS RETAINED FROM MOVENTUM FINF1NF= .1105678E+01
---CCDF IS USED AND BASED ON 31 IN ALFA1 CIRF= ---
CCDF= .1113424E+01 JCCDF= .77465322E+01 L/C= .64765365E+01
---CAV1V SAVF=-----

```

```

Y= .
Y= .631-691E-00 Y= .6492576E-03
Y= .9746145E-03 Y= .2317521E-02
Y= .1212632E-02 Y= .4781095E-02
Y= .5999034E-01 Y= .7502726E-02
Y= .1171302E-01 Y= .1097630E-01
Y= .17149337E-01 Y= .1390447E-01
Y= .2577275E-01 Y= .1929394E-01
Y= .3575755E-01 Y= .2344114E-01
Y= .5151277E-01 Y= .3033030E-01
Y= .8733338E-01 Y= .3612346E-01
Y= .13749133E-01 Y= .4265342E-01
Y= .1111658E-01 Y= .4951793E-01
Y= .13333609E-01 Y= .5557795E-01
Y= .1699743E-01 Y= .6366164E-01
Y= .2025774E-01 Y= .7057717E-01
Y= .2336339E-01 Y= .7712992E-01
Y= .2764372E-00 Y= .8314294E-01
Y= .3152376E-00 Y= .8347539E-01
Y= .3542943E-01 Y= .9333199E-01
Y= .3929527E-01 Y= .9676462E-01
Y= .43365913E-01 Y= .9946745E-01
Y= .4671235E-01 Y= .1017661E+00
Y= .5019957E-01 Y= .1031069E+00
Y= .5331632E-01 Y= .1037473E+00
Y= .56633681E-01 Y= .10374405E+00
Y= .5992142E-01 Y= .1031673E+01
Y= .63241472E-01 Y= .1020583E+01
Y= .6674438E-01 Y= .1004663E+01

```

π^+	$0.712732E+0.0$	π^-	$-0.334275E-0.1$
π^0	$0.6384025E+0.0$	η^0	$-0.7356489E-0.1$
η^0	$-0.712336E+0.0$	$\eta^{\prime}0$	$-0.7116628E-0.1$
$\eta^{\prime}0$	$-0.741939E+0.0$	$\eta^{\prime\prime}0$	$-0.5384533E-0.1$
$\eta^{\prime\prime}0$	$-0.7613282E+0.0$	$\eta^{\prime\prime\prime}0$	$-0.6117747E-0.1$
$\eta^{\prime\prime\prime}0$	$-0.770564E+0.0$	$\eta^{\prime\prime\prime\prime}0$	$-0.8207743E-0.1$
$\eta^{\prime\prime\prime\prime}0$	$-0.7335931E-0.1$	$\eta^{\prime\prime\prime\prime\prime}0$	$-0.7744441E-0.1$
$\eta^{\prime\prime\prime\prime\prime}0$	$-0.6117272E+0.1$	$\eta^{\prime\prime\prime\prime\prime\prime}0$	$-0.7231449E-0.1$
$\eta^{\prime\prime\prime\prime\prime\prime}0$	$-0.6263257E+0.0$	$\eta^{\prime\prime\prime\prime\prime\prime\prime}0$	$-0.6540113E-0.1$
$\eta^{\prime\prime\prime\prime\prime\prime}0$	$-0.6092239E+0.0$	$\eta^{\prime\prime\prime\prime\prime\prime\prime\prime}0$	$-0.5341922E-0.1$
$\eta^{\prime\prime\prime\prime\prime\prime}0$	$-0.5617062E+0.1$	$\eta^{\prime\prime\prime\prime\prime\prime\prime\prime\prime}0$	$-0.5059937E-0.1$
$\eta^{\prime\prime\prime\prime\prime\prime}0$	$-0.5593948E+0.0$	$\eta^{\prime\prime\prime\prime\prime\prime\prime\prime\prime\prime}0$	$-0.4735566E-0.1$

-----**FOR EASY SHARE**-----

12	0.2	Y2	0.13446
12	0.4	Y2	0.11594
12	0.6	Y2	0.11164
12	0.8	Y2	0.10734
12	1.0	Y2	0.10304
12	1.2	Y2	0.10834
12	1.4	Y2	0.10404
12	1.6	Y2	0.10974
12	1.8	Y2	0.10544
12	2.0	Y2	0.11114
12	2.2	Y2	0.10684
12	2.4	Y2	0.11254
12	2.6	Y2	0.10824
12	2.8	Y2	0.11394
12	3.0	Y2	0.10864
12	3.2	Y2	0.11434
12	3.4	Y2	0.10904
12	3.6	Y2	0.11474
12	3.8	Y2	0.10944
12	4.0	Y2	0.11514
12	4.2	Y2	0.11084
12	4.4	Y2	0.11654
12	4.6	Y2	0.11124
12	4.8	Y2	0.11694
12	5.0	Y2	0.11264
12	5.2	Y2	0.11734
12	5.4	Y2	0.11304
12	5.6	Y2	0.11774
12	5.8	Y2	0.11344
12	6.0	Y2	0.11814
12	6.2	Y2	0.11384
12	6.4	Y2	0.11954
12	6.6	Y2	0.11424
12	6.8	Y2	0.11994
12	7.0	Y2	0.11464
12	7.2	Y2	0.12064
12	7.4	Y2	0.11534
12	7.6	Y2	0.12134
12	7.8	Y2	0.11604
12	8.0	Y2	0.12194
12	8.2	Y2	0.11674
12	8.4	Y2	0.12264
12	8.6	Y2	0.11744
12	8.8	Y2	0.12334
12	9.0	Y2	0.11814
12	9.2	Y2	0.12404
12	9.4	Y2	0.11884
12	9.6	Y2	0.12474
12	9.8	Y2	0.11954
12	10.0	Y2	0.12544

0.132358E-02 .713643E-01 .922173E-01 .334415E-01 -.713097E-01 .913002E+00
 +0.102168E+01 -.61145742E+00
 +0.3911166E+01 -.61298315E+00
 +0.3750931E+01 -.61251497E+00
 +0.6654066E+01 -.61225178E+00
 +0.9522938E+01 -.61139755E+00
 +0.7124452E+01 -.61111314E+00
 +0.2444595E+01 -.61088406E+00
 +0.6036262E+01 -.61026465E+00
 +0.3941604E+01 -.60927376E+00
 +0.7614982E+01 -.60824612E+00
 +0.3611313E+01 -.60723356E+00
 +0.4335158E+01 -.60622767E+00
 +0.2247446E+01 -.60536473E+00
 +0.5441626E+01 -.60517877E+00
 +0.72441772E+01 -.60501122E+00
 +0.7613163E+01 -.60493945E+00
 +0.7611355E+01 -.60481245E+00
 +0.71354422E+01 -.60434277E+00
 +0.62921235E+01 -.60393365E+00
 +0.3813713E+01 -.60311993E+00
 +0.611955E+01 -.60397781E+00
 +0.5957777E+01 -.60303719E+00
 +0.5957777E+01 -.60303719E+00
 +0.31436215E+01 -.60229472E+00
 +0.7177242E+01 -.60252604E+00
 +0.4218381E+01 -.60171951E+00
 +0.6179938E+01 -.60154718E+00
 +0.3411521E+01 -.6015216E+00
 +0.1476938E+01 -.60046327E+00
 +0.3451529E+01 -.5996148E+00
 +0.6652761E+01 -.59578215E+00
 +0.7721575E+01 -.59437437E+00
 +0.3750567E+01 -.59419997E+00
 +0.317771E+01 -.59352237E+00
 +0.651694E+01 -.59446758E+00
 +0.2444318E+01 -.59248686E+00
 +0.3961776E+01 -.59131133E+00
 +0.1675217E+01 -.59051338E+00
 +0.7144374E+01 -.58923337E+00
 +0.3111777E+01 -.58427532E+00
 +0.3111777E+01 -.58427532E+00
 +0.5546753E+01 -.58372327E+00
 +0.2444121E+01 -.58324846E+00
 +0.5721454E+01 -.58363755E+00
 +0.3711344E+01 -.58138169E+00
 +0.6411171E+01 -.58117132E+00
 +0.6111151E+01 -.58205667E+00
 +0.4467541E+01 -.58128718E+00
 +0.5171151E+01 -.58135877E+00
 +0.7713329E+01 -.58129445E+00
 +0.4191151E+01 -.58101475E+00
 +0.1773211E+01 -.58082611E+00
 +0.1616591E+01 -.5807461E+00
 +0.3444121E+01 -.58068112E+00
 +0.2444121E+01 -.58073217E+00
 +0.2717315E+01 -.58736422E+00
 +0.2477315E+01 -.58561251E+00
 +0.2223151E+01 -.58525413E+00
 +0.1799342E+01 -.58397813E+00
 +0.1731664E+01 -.58350741E+00
 +0.1853511E+01 -.58115035E+00
 +0.1311917E+01 -.58117645E+00
 +0.1112415E+01 -.58035819E+00
 +0.9346395E+01 -.58139122E+00
 +0.7313151E+02 -.58104773E+00
 +0.5611234E+02 -.58037914E+00
 +0.4465871E+02 -.58044633E+00
 +0.2679431E+02 -.58086649E+00
 +0.1493761E+02 -.58032623E+00
 +0.5727131E+02 -.58051700E+00
 0.
 +0.5711643E+00
 +0.3153259E+01
 +0.1421839E+01 -.58115412E+00
 +0.4543158E+01 -.58136669E+00
 +0.15277401E+01 -.58117746E+00
 +0.2111667E+01 -.58127217E+00
 +0.617351E+01 -.58116665E+00
 +0.1744115E+01 -.58134122E+00
 +0.55733735E+01 -.58137935E+00
 +0.236463E+01 -.58119342E+00
 +0.5566511E+01 -.58106144E+00
 +0.3336113E+01 -.58101503E+00

.7027601E-31 -.3140792E+01
.73233E+0-01 -.3141.79E+01
.76e378e3-01 -.3141242E+01
.79711e5-01 -.3141503E+01
.8262097E-01 -.3141848E+01
.8553047E-01 -.3142.90E+01
.8836e75E-01 -.3142313E+01
.9113725E-01 -.3142545E+01
.93746e4E-01 -.3142759E+01
.9644662E-01 -.3142972E+01
.9903550E-01 -.3143175E+01
.0115552E-01 -.314337e2E+01
.0104484E-01 -.3143369E+01
.0105532E-01 -.3143790E+01
.0105532E-01 -.314393E+01
.0113547E-01 -.3144124E+01
.0115706E-01 -.3144289E+01
.0121533E-01 -.3144472E+01
.0121375E-01 -.3144639E+01
.0122207E-01 -.3144844E+01
.0122851E-01 -.3144964E+01
.012357E-01 -.3145120E+01
.0127221E-01 -.3145274E+01
.0129424E-01 -.3145425E+01
.0131144E-01 -.3145572E+01
.0133553E-01 -.3145719E+01
.0137265E-01 -.3145956E+01
.0137793E-01 -.3146296E+01
.0139793E-01 -.3146127E+01
.0101791E-01 -.314e159E+01

5.0

LISTING OF PCASE

```

PROGRAM PCASE(INPUT,DUPUT,TAPE5=INPJ1,TAPE6=DJPUT,TAPE7,TAPE1)
C NONLINEAR PARTIALLY CAVITATING CASCADE CALCULATIONS.
C 5/17/1973 PROGRAMMED BY D. FJRJYA.
DIMENSION Y3E(5),XZ(5),BETA0(513),BETAM0(513),BETAJ2(100)
DIMENSION SXSI(5),XXX(513),CP(513),INT(10),XCP(5),YCP(5)
DIMENSION FL(200),FD(200),C2(101),XXX2(201),FL2(100),FD2(100)
CJ440V/FOILEND/XXDD,YYDD
CJ440V/FREECAV/XFREEC,YFREEC
COMMON/DELTAD/DELT(5,5)
COMMON/YCCC+SBETA2
CJ440V XIT4(200),XITV(200),ANSG2S(200),SARC2(200)
CJ440V CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAV,LPM4,NS2
CJ440V AJ(100),ISHARP,YCHBY,BBTAV(100),BBTAV2(100),BETAV2(100)
COMMON FLAPAN,DELTA,JGAP,ALFA1,GAMMA
COMMON SIGMA,SBETA,XXM,ICPI,SARC00(513)
CJ440V IDJL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
CJ440V XS(5),CCC1,CL,E,ER,C,YYY,XM,ITERA,SXS10(6),SXS10(6),YXS(6)
CJ440V PSIZ,L,P,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XROJND,A2AA,3233,C2CC
CJ440V AAAA,BBBB,CCCC,A8,B8,C8,D8,TGAUS(100),NGAUS(100),NGAUS
CJ440V BETAV----FOR ARC 1 FOR REGULAR INTEGRAL.
CJ440V BBTAV IS FOR INTERPOLATED VERSION OF BETAN .
CJ440V BETAN2 FOR EQUALLY SPACED INCREMENT FOR ARC 2.
CJ440V BBTAN2 FOR CHEBYCHEV- GAUSS VERSION OF BETAN2.

HT/KCIHT/N0440C
ECAPSE )095,5( DAER
ECAPSE )0985,6( ETIRW
)4,3F,-----SVICAPS _EDCV EKAW NEP0-----,XG1( TAMROF 0885

PAI=3.141592653
REAJ(5,795) NGAUS
VGAJS1=VGAJS+1
VVV2=VGAJS/2
VGAJS2=VVV2+1
READ(5,560) (TGAUS(I),I=NGAJS2+VGAUS)
READ(5,560) (WGAUS(I),I=NGAJS2+VGAUS)
DO 26 IQ=1,VVV2
TGAJS(IQ)=TGAJS(VGAJS1-IQ)
26 WGAUS(IQ)=WGAUS(NGAJS1-IQ)
WRITE(5,561) (TGAUS(I),I=NGAUS2,NGAJS)
WRITE(5,562) (WGAUS(I),I=NGAUS2,NGAJS)
560 FOR4AF(4F20.10)
561 FOR4AF(1X,*T(I)=*,10(F10.8,1X))
READ(5,590) XX4

DO 589 IDELT=1,6
589 READ(5,590) (DELT(I)D_T4,I),I=1,5
592 FOR4AF(1X,*d(I)=*,10(F10.8,1X))

READ(5,560) TM,XXDD,YYDD
READ(5,560) R,AAA,A,B333,CCCC
READ(5,560) A8,B8,C8,D8
READ(5,560) XROJND,A2AA,3233,C2CC
READ(5,560) AAAA,J,B333J,CCCCJ
READ(5,560) A8U,B8J,C8U,D8J
READ(5,560) A2AAJ,B333J,C2CC
READ(5,795) IFLAG1 ,YCHBY

```

```

      READ(5,1321) SBETA ,SBETAA2,SF4,BETAB,BETAC
      READ(5,551) LPMS,LPKS,LPM2,IFLAG,IREAD,ISHARP
      READ(5,201) NITER,NSTD,P,MAXIT,V4K
      READ(5,202) ALFA1S,SALIAS,SJLIS, SIGMS
      READ(5,229) DE,DG,DF
      DD 592 IDETA=1,6
      592 WRITE (6,591) (DELT(I)DETA,I=1,6)
      WRITE(6,653)
      5533 FORMAT(1H1)

      YYDD=48U+88U+C8U+D8J
      WRITE(6,5375)XXJ,YYJ
      5835 FORMAT(20X,*X AND Y COORDINATES OF UPPER BLADE END POINT=*,1H(,
      * F7.5,1H,,F7.5)
      WRITE (6,5690) TH,XXM
      WRITE(6,5551) BETAB,BETAC
      WRITE(6,555) 1,AAAAA,B3B3B,CCCC
      WRITE(6,555) A8,B8,C8,D8
      WRITE(6,557) XRDJND,4244,B233,C2CC
      WRITE (6,523) AAAAU,B3B3U,CCCCU
      WRITE(6,524) A8J,B8J,C8J,D8J
      WRITE(6,525) A2AAU,B2B3U,C2CCU
      WRITE(6,1229) LPMS,-PKS,SETA,IREAD,NCHBY
      WRITE(6,1324) DE,DG,DF,SF4
      WRITE(6,1521) SBETA2
      590 FDR4AT (8F10.3)
      591 FORMAT (10X,*DELT(A,I,J)=*,6(F10.8,2X))
      5530 FORMAT (20X,*THICKNESS OF 2-AND CIV/EX FOIL = *,F10.5,10X,*XXI=*,*
      1*10.5)
      523 FORMAT(20X,*A2AAU=*,F10.6,2X,*B2B3U=*,F10.6,2X*C2CCU=*,F10.6)
      555 FORMAT(20X,*R=*,F5.2,2X,*444&=*,F10.6,2X,*B3B3=*,F10.6,2X,*CCCC=*,*
      XF10.6)
      555 FORMAT(20X,*A8=*,F10.6,2X,*B8=*,F10.6,2X,*C8=*,F10.6,2X,*D8=*,F10.6)
      557 FORMAT(20X,*XRDJND=*,F10.6,2X,*A2AA=*,F10.6,2X,*B2B3=*,F10.6,2X,*C
      *2CC=*,F10.6)
      523 FORMAT(20X,*AAAAU=*,F10.6,2X,*B3B3U=*,F10.6,2X,*CCCCU=*,F10.6)
      524 FORMAT(20X,*A8U=*,F10.6,2X,*B8J=*,F10.6,2X,*C8J=*,F10.6,2X,*D8U=*,*
      1 F10.6)
      !IFLAG1+++ IFLAG=1 FOR THE FIRST RUN & IFLAG=0 FOR PREVIOUS DATA JSE.
      !IFLAG1=0 FOR REGULAR RUNS, IFLAG1NE0FOR RUNS OF READING DATA FROM CASCLIN.
      !IFLAG1NE0 NEED EXTRA DATA FOR SXSI(2) AND SXSI(3).
      533 FORMAT(3I10)
      !AAAA,B3B3,CCCCARE CONSTANTS FOR 2-TERM CAMBER, X AND SQRT(X)
      !-----CALCULATED FROM ANOTHER PROGRAM CALLED *CAMBER-----.
      !A8,B8,C8 AND D8 ARE COEFFICIENTS FOR POLYNOMIALS FOR X GREATER THAN .8.
      !A1AJ,A2AAJ,A8J ETC... ARE THE SAME AS AAAA ETC... EXCEPT THEY ARE
      !FOR THE UPPER FACE OF THE FOIL
      !.D1 AND C10K ARE VOID DJ44Y.
      !SF4 IS USED FOR DETERMINING WHETHER TO CALCULATE BETA.
      1321 FDR4AT(5E14.7)
      !IFLAG1 NEEDS DATA CARDS FOR SXSI(1), I=1,5, IREAD MAY BE SET TO 5.
      !IFLAG=0 , DATA WILL BE READ EITHER FROM
      ! DATA CARD, IF IREAD=5
      ! TAPE1 , IF IREAD=1.
      551 FORMAT(10I8)
      211 FDR4AT(4I3)
      212 FDR4AT(4E14.7)
      !DE,DG,DF ARE THE INCREMENTS FOR DERIVATIVES IN DX-FNU.

```

```

C 03=1.E-3 S CF=1.E-5 ARE USED BEFORE.
229 FJRYAT(3E14.7)
1229 FORMAT(5X,4HLPM=,I4,2X,4HLPK=,I4,2X,6HSBETA=,E14.7,5X,6HREAD=,I1,
      X2X,+NC4BY=*,I3)
5551 FJRYAT(20X,*BETAB AV3 BETAC AS FIRST GUESS=*,=10.5,2K,F10.5)
1324 FJRYAT(10X,3HDE=,E14.7,2X,34DG=,E14.7,3HDF=,E14.7,2X,4HSF4=,E14.7)
1521 FJRYAT(10X,*SBETA2=*,E14.7)
      SBETA2=SBETA2*PAI/180.
      BETAB=BETAB*PAI/180.
      BETAC=BETAC*PAI/180.
C -P442LPM2=NS2
      LP44=LPM2
      NS2=L342
      L3441=L344+1
      WRITE(6,1459) LPM2,ISHARP
1459 FJRYAT(10X,*LPM2=*,I3,2X,*ISHARP=*,E14.7)
C ISHARP=0 FOR SHARP L.E.
C      1 FOR ROUNDING L.E.
      SBETA=SBETA*PAI/180.
      DC 999 IJKL=1,NITER
C FFF4 IS PROVIDED FROM JEWEL, BUT IF THE LOOP DOES NOT GO THROUGH
C IT, FFF4 OF PRESET VALUE MUST BE USED.
      FFF4=0.
      ALFA1D=ALFA1S
      GAMMA0=GAMMAS
      SOLID=SOLID
      SIGMA=SIGMAS
      IF(VH<.EG.1) GO TO 240
      IF(VH>.EG.2) GO TO 241
      IF(VH>.EG.3) GO TO 242
      SIGMA=SIGMAS-0.01*FLDAT(IJKL-1)
      GO TO 243
242 SOLID=SOLID+0.1*FLOAT(IJKL-1)
      GO TO 243
241 GAMMA0=GAMMAS+2.*FLDAT(IJKL-1)
      GO TO 243
240 ALFA1D=ALFA1S+2.*FLDAT(IJKL-1)
243 CONTINUE
      X4=XX4
      ALFA41=ALFA1D*PAI/180.
      DS4P=1./SOLID
      GAMMAA=GAMMA0*PAI/180.
      DELTA=ALFA41+GAMMA
      F_APAN=0.
      WRITE(6,665) ALFA1D,GAMMA0,SOLID
555 FORMAT(1X,1SHINCIDENCE ANGLE=,E14.7,1X,6H3AMA=,E14.7,1X,9HSOLIDIT
      XY=,E14.7)
      WRITE(6,653) FLAPAN
553 FORMAT(5X,11HFLAP ANGLE=,E14.7)
      STOLL=2.E-4
      STOL=5.E-4
      ERC=1.E-2
      C_E=1.E-4
C CAVIT. NO.=SI3MA, AND PSIZ.
      WRITE(6,511) SIGMA
511 FJRYAT(10K,114CAVIT. VJ =,E14.7)
      CCC1=ALOG(1.+SIGMA)/(2.*PAI)
C SPECIFY HYDROFOIL'S CHARACTERISTICS AND SEP. POINTS.
      XC=0.
      YC=0.

```

```

X3=0.
XA=1.
WRITE(6,502)XA,XB,XC,YC,XXDD,YYDD
502 FORMAT(10Y,6HCHORD=,E14.7,2X,17HUPPER SEP. POINT=,E14.7,2Y,20HCONN
X. PJOINT(XC,YC)=(,E14.7,1H,,E14.7,1H)/* XXDD=*,F10.6,2X,*YYDD=*,,
Y =10.6)
C START ITERATIVE PROCEDURE.
C ----BASIC FLOW IS THAT OF FLAT PLATE-----
C ITERAT IS INDEX FOR NUMBER OF ITERATIONS.
ITERA=1
IF(IFLAG.EQ.0) ITERA=2
BIGS=0.
XHIGH=0.
XL0=0.
IS1I2=0
XINCRT=XA/50.
D1 243 IIVC=1,50
XL0=XHIGH
XHIGH+=XL0+XINCRT
CALL ARCLEV(S,XL0,XHIGH,IS1I2)
248 BIGS=BIGS+S
WRITE(6,504) BIGS
504 FORMAT(10X,5HBIGS=,E14.7)
STOL=1.E-5
LPM=LPM
LPK=LPKS
LPM1=LPM-1
LPM3=LPM-3
C ICPI IS USED FOR CONTROLLING PROGRAM: 0 FOR ITER. 1 FOR THE REST.
C FIND XSIB,XSIC,XSIF,A+ALFA2 BY USING NEWTON'S METHOD.
C SXSI(1)=XSIB
C SXSI(2)=XSIC
C SXSI(3)=XSIF
C SXSI(4)=A WHICH IS THE COEFFT. OF MAPPING FCN.
C SXSI(5)=A_F2
C SXSI(6)=SPACE (RATIO OF SPACE OF BLADES AT UPSTREAM AND DOWNSTREAM)
    IF(IKFL.GE.2) GO TO 630
    IF(IFLAG.EQ.0) GO TO 761
C INITIAL GUESS FOR SXSI(I) IS -----
    READ(5,769) SXSI(1),SXSI(2),SXSI(3),SXSI(4),SXSI(5),SXSI(6)
    GO TO 150
C THIS IS THE CASE THAT OLD DATA ARE USED WITH PUNCHED CARDS.
751 CONTINUE
    IF(IFLAG1.EQ.0) GO TO 779
    READ(1,620) SXSI(1),SXSI(2),SXSI(3),SXSI(4)
    SXSI(5)=SXSI(3)
    READ(5,779) SXSI(2),SXSI(3)
778 FORMAT(2E14.7)
    GO TO 529
779 READ(IREAD,620) SXSI(1),SXSI(2),SXSI(3),SXSI(4),SXSI(5),SXSI(6)
620 FORMAT(6E13.6)
529 DO 621 IC=1,LPM
621 READ(IREAD,622) SARC(IC),BETAV(IC)
622 FORMAT(2E14.7)
    DO 1621 IC=1,LPM1
1621 READ(IREAD,622) SARC2(IC),BETAV2(IC)
    IF(IFLAG.EQ.0) GO TO 480
    GO TO 481
480 DO 482 IBT=1,LPM1
482 BETAM(IBT)=.5*(BETAV(IBT)+BETAV2(IBT+1))

```

```

431 CONTINUE
150 ICPI=0
  WRITE(6,102) ITERA
132 FORMAT(10X,14HITERATION NO.=,I2)
  DO 650 IRP=1,6
550 SXSI0(IRP)=SXSI(IRP)
  IF(ITERA.GE.2) STOL=STOLS
  IF(ITERA.EQ.MSTOP) STOL=STDLL

      ..
      ..

      CALL DXFNEW(SXSI,STDLL,MAXIT,ITN,DS,DF,FFF4)

      ..

530 CONTINUE
  DO 537 IC1=1,6
  XSV(IC1)=SXSI(IC1)
537 WRITE(6,536) IC1,SXSI(IC1)
536 FORMAT(10X,5HSXSI(,I1,2H)=,E14.7)
  CSPACE=(1.0*SXSI(1))/FLDAT(LPK)
  +CSPACE=0.5*CSPACE
  -SPACE=CSPACE/F_LDAT(-PK-LPK)
  HFSPACE=0.5*-SPACE
  XBET=-1.0+CSPACE+F_LDAT(-PK-1)
  ICPI=1
C ICPI=0 FOR FINDING SXSI(I), I.E., SXSI(I)=YXS(I) > ICPI=1 FOR THE REST.
C CALCULATION OF PRESSURE DISTRIBUTION ICPI.
  IF(ITERA.EQ.1) GO TO 36
  DO 35 IB=1,-P4
35 BETANO(IB)=BETAN(IB)
  DO 37 IB=1,-P41
37 BETAMO(IB)=BETAM(IB)
  DO 355 IB=1,LPM441
355 BETAO2(IB)=BETAV2(IB)
36 CONTINUE
  JJ2=CJS(ALFA1+GAMMA1)/CJS(SXSI(5)+GAMMA1)/SXSI(5)
  >AMMAG+>5(LISXS(SOC)/AMMAG+1AFLA(SOC=2UJ
C
  JJ22=JJ2**2
  DO 25 -Q=1,LPM
  -Q=-Q
C FIND CP(XSIP) NEXT.
C---- FOR THE FIRST WETTED ARC PORTION S1-----
C IS BASED ON J1 AND P1.
C LP=1 IS NEAR THE T_E.
C -P4 IS NEAR THE -E.
  IF(LF.EQ.1) GO TO 521
  IF(-P,EQ.-P4) GO TO 52
  Z2=EXP(XITV(LP))
C XITVO1 IS CALCULATED IN DFSIM42 OF DXFNEW FOR F(4).
  Z2=Z2**2
  CP(LP)=1.0-ZZ22*Z2
  GO TO 522
52 CP(LP)=-SIGMA
  GO TO 522
521 CP(LP)=1.0-JJ22
522 CONTINUE
25 CONTINUE

```

```

EUNITNOC 431
.0=MPL(PC
)3.021X,PCY,PCX(NEKTIA=)1-MPL(PC
)3.911X,PCY,PCX(VE<TI=)2-MPL(PC
ECAPSF-1(I(SXS=021X
ECAPSF*.2-1(I(SXS=911X
.0=)4(PCY
)3-MPL(PC=)3(PCY
)5-MPL(PC=)2(PCY
)7-MPL(PC=)1(PCY
)1(I(SXS=)4(PCX
ECAPSF*.2-2(PCX=)3(PCX
ECAPSF*.2-1(PCX=)2(PCX
ECAPSF*.7-1(I(SXS=)1(PCX
431 OT 06 )1.GE.ARETI(FI

```

*****MAIN INSERT 1*****

```

-----CP FOR THE SECOND ARC S2-----
NUMBER OF CONTROL POINTS ON S2 IS FIXED
IN SUBROUTINE DFSIM5. I.E.,
HALF OF THE POINT USED FOR BETA
ANSG2S IN C044DN = 52.
C0 550 NCP = 1,-P441
IF(NCP.EG.1) GO TO 581
IF (NCP.E2.-P441) G0 TO 582
Q2 = EXP(ANSG2S(NCP))
Q2 = Q2**2
CP2(NCP) = 1.-Q2*UU22
G0 TO 580
531 CP2(NCP) = -SIGMA
G0 TO 580
532 CP2(NCP) = 1.-JJ22
580 CONTINUE

```

*****MAIN INSERT 1*****

```

A=4=ABS(FFF=4)
I=(AF4.GE.SF4) GO TO 1135
G0 TO 1134
1135 WRITE(5,1136)
1135 FORMAT(5X,F4) IS I30 LARGE TO CALCULATE BETA*)
ST39
C FIND XXX(XSIP) FIRST.
1134 C0VTINJE
IS1S2=0
-----FIRST BETA FOR ARC 1-----
G0 100 LLP=1,LPM
LP=P4-LLP+1
CALL BBBETA(XXYX,BETA,IS1S2)
XXX(LP)=XXYX
BETAN(LP)=BETA
IF(LP.EG.LPM) BETAB=BETA
IF(ITERA.E4.MSTP1) G0 TO 100
WRITE(5,101) LP,SARC(-P),XXX(-P),CP(LP),BETAN(LP)
100 CONTINUE

```

```

101 FDR4AT(1K+2*I=,I3,1K,5*SARC2=E14.7,1K,4HXXX=E14.7,1K,34CP=E14.7,
X1K+6HBTAV=E14.7)

*****MAIN INSERT 2 *****

-----BETA FOR ARC S2-----
SARC2 HAS BEEN CALCULATED
IN SJROUTINE DFSI45 AND
STORED IN COMMON AREA.

IS1S2 = 1
DO 429 LLP=1,LPMM1
  _D=LL
  CALL 333ETA(XYX,BETA,IS1S2)
  IF(LL.EQ.1) BETAC=BETA
  XXX2(LP) = XYX
  BETAN2(LP) = BETA
  IF(ITERA.EQ.MST) GO TO 329
  WRITE(5,239) LP,SARC2(LP),XXX2(LP),CP2(LP),BETAN2(LP)
239 FORMAT(9X*I=,I3+1K*+SARC2=*,E14.7,1X+*XXX2=*,E14.7,
      *E14.7,1X+*CP2=*,E14.7,1X+*BETAN2=*,E14.7)
329 CONTINUE
429 CONTINUE

*****MAIN INSERT 2 *****

*****MAIN INSERT 3 *****

-----FIND LIFT AND DRAG.
-----FIRST CL AND CD FOR S1 PART.
JSID = SIN(DELTA)
JC00 = COS(DELTA)
UXE = SXSI(4)*UC00
JXB2 = UX3**2
DO 105 ITK = 1,LPM
IF(ITK.GT.PK) GO TO 106
XPS = -1.*CSPACE*FLOAT(ITK-1)
GO TO 108
105 XPS = X3ET+FSPACE*FLOAT(ITK-LPK)
108 CONTINUE
UXA = XPS-SXSI(4)*JSID
UXA2 = UXA**2
PXXP = UC00/(UXA2+JXB2)
DWDX = DGAP*PXXP*XPS/PAI
COBET1 = COS(BETAV(ITK))
SIBET1 = SIN(BETAV(ITK))
DS1DX = -EXP(-XITV(ITK))*DWDX/UJ22
S1 IS CALCULATED AT JSIM2 AS XITV(I).
AND STORED IN COMMON.
IF(XPS.LT.0.) DS1DX = -DS1DX
XLP1 = DS1DX*CP(ITK)
FL(ITK) = -XLP1*COBET1
FJ(ITK) = XLP1*SIBET1
105 CONTINUE
-----CL AND CD FOR S2 PART.
NS21=VS2+1

```

```

VS2A=VS2-1
GAP2 = (SXSI(3)-S1S1(2))/NS2
DO 339 ITK = 1, NS21
XRS2 = SXSI(2)+S1A22*(IT<=1)
UXA = XRS2-SXSI(4)*JSID
UXA2 = JXA**2
PXXP = UCCD/(UXA2+UX32)
DXDX = DGAP*PXXP*XRS2/PAI
CDBET2 =-COS(BETAV2(IT<))
SIBET2 =-SIN(BETAN2(ITK))
DS2JX = EXP(-ANS32S(IT<))*DXDX/JJ22
C  G2 IS ALREADY CALCULATED AT OFSIM5 AS
C  ANSG2S(I), STORED IN COMMON AREA.
X_P2 = DS2JX*C1P2(IT<)
F_2(IT<) = -X_P2*CDBET2
FD2(IT<) = X_P2*SIBET2
338 CONTINUE
SPACE = CSPACE
CLIFT = 0.5*CSPACE*FL(2)+0.5*FSPACE*FL(LPM1)
CDRAG = 0.5*CSPACE*FD(2)+0.5*FSPACE*FD(LPM1)
DO 111 IUA = 2,LPM3+2
I=(IJA+GE-LPK) SPACE = FSPACE
CLIFT = CLIFT+SPACE*(FL(IJA)+4.*FL((IJA+1)+FL((IJA+2))/3.
111 CD1AG = CD1AG+SPACE*(FD(IJA)+4.*FD(IJA+1)+FD(IJA+2))/3.
DO 321 IJA = 1,VS2A+2
CLIFT = CLIFT+GAP2*(FL2(IJA)+4.*FL2(IJA+1)+FL2(IJA+2))/3.
321 CDRAG = CDRAG+GAP2*(FD2(IJA)+4.*FD2(IJA+1)+FD2(IJA+2))/3.
C-----ADD THE FORCES ON CAVITY PORTIONS.
C  SJROUTINE XCYC CALCULATES
C  THE POINT ON THE UPPER BLADE PORTION CORRESP. TO THE CAVITY END POINT.
CXA=XCCC
CYA=YCCC
CALL XCYC(XCCC,B,YCCC,B,CXA,CYA)
CLIFT = CLIFT+SIGMA*1CCC
CDRAG = CDRAG-SIGMA*YCCC
C-----XCCC AND YCCC ARE THE END POINTS OF CAVITY, CALCULATED IN
C SJROUTINE CAVITY
C STORED IN COMMON.
C
C*****MAIN INSERT 3 *****
C
C FINF BINF IV 2=1.
U2U1=COS(ALFA1+GAMMA)/COS(SXSI(5)+GAMMA)/SXSI(6)
DOWN=CD1S(ALFA1+GAMMA)+COS(SXSI(5)+GAMMA)/SXSI(6)
BINF=0.5*SQRT(ALFA1+SXSI(5)+2.*GAMMA)/DOWN
BINF=ATAN(1./BINF)
AINF=0.5*PAI-BINF-GAMMA
C COSTAR AND ALSTAR ARE BASED ON VELOCITY AT UPSTREAM INFINITY IN (X,Y).
CD1STAR=CD1A3
CL1STAR=CLIFT
JIVF=0.5*SQRT(1.+U2J1**2+2.*J2J1+COS(ALFA1-SXSI(5)))
FINF=2.*DSAP*SIN(ALFA1-SXSI(5))/(UINV+COS(SY1S(5)+GAMMA))
CLINV=CL1STAR+COS(AINV)-COSTAR*SIN(AINV)
COINV=CLINV*SIN(AINV)+COSTAR*COS(AINV)
CINV=CLINV/UINV**2
COINV=COINV/UINV**2
WRITE(6,117) CLINV,COINV
117 FORMAT(1X,3HCLINV DR COINV=FORCE/1/2RC.UINV**2,5H.CINV=,E14.7,

```

```

KIX,5HCDIMF=,E14.7)
  WRITE(6,119) FIVE
113 FORMAT(1X,3H=INF IS OBTAINED FROM MOMENTUM E3V,5HFIVE=,E14.7)
  WRITE(6,221)
221 FORMAT(1X,4H---CC-- S CDDJ ARE BASED ON J1 IN ALFA1 DIRE.---)
CCLL=CCLSTAR*COS(ALFA1)-COSTAR*SIN(ALFA1)
CDDJ=CSTAR*SIN(ALFA1)+COSTAR*COS(ALFA1)
ALDD=CCLL/CDDJ
  WRITE(6,191) CCLL,CDDJ,A_DJ
131 FORMAT(1X,5HCCDD=,E14.7,1X,5HCCLL=,E14.7,1X,4HL/D=,E14.7)
  MSTDP1=MSTDP-1
  IF(ITERA.EQ.MSTDP1) GO TO 140
  *
  *
  *****MAIN INSERT 4 *****
  *
  * CAVITY SHAPE.
  *  ALREADY CALCULATED IN
  *    SUBROUTINE CAVITY.
  *    WRITE(6,237)
237 FORMAT(2X,4H-----CAVITY SHAPE-----)
  VCAV1=VCAV+1
  DO 235 KCAV=1,NCAV1,2
235  WRITE(6,235) CAVX(KCAV),CAVY(KCAV)
  236 FORMAT(10X,*X=*,E14.7,10X,*Y=*,E14.7)
  *
  *
  *****MAIN INSERT 4 *****
  *
  * 140 CONTINUE
  * KCCC=0.
  * YCCC=0.
  * WRITE(6,823)
923 FORMAT(//,4H-----UPPER BODY SHAPE-----)
  DO 921 IS4P=1,51
  X=.32*(IS4P-1)
  CALL SHAPE(X,Y,BETA,3)
921  WRITE(6,822) X,Y
922 FORMAT(5X,*X=*,F10.5,2X,*Y=*,F10.5)
  REWIND 7
  WRITE(7,768) SXSI(1),SXSI(2),SXSI(3),SXSI(4),SXSI(5),SXSI(6)
768 FORMAT(6E13.6)
  DO 766 IC=1,LPY
766  WRITE(7,767) SARC(IC),BETAN(IC)
767  FORMAT(2E14.7)
  DO 1766 IC=1,LPMMI
1766  WRITE(7,767) SARC2(IC),BETAV2(IC)
  IF(ITERA.GE.MSTDP) GO TO 999
  _P1=-PK-1
  SPACE=CSPACE
  HSPACE=MCSPAC
  DO 50 IM=1,-P41
  IF(IM.EQ.1) GO TO 51
  I=(IM,E3,-P41) GO TO 55
  IF((IM,E3,-P1)) GO TO 37
  I=(IM,E3,-P1) GO TO 93
  I=(IM,GT,LP1) GO TO 93
  XY=-1.+SPACE+FLOAT(IM-1)*4SPACE

```

```

XZ(1)=-1.0+SPACE+F_LDAT(IM-2)
XZ(2)=XZ(1)+SPACE
XZ(3)=XZ(2)+SPACE
XZ(4)=XZ(3)+SPACE
GO TO 95
93 SPACE=SPACE
MSPACE=MFS*AC
K=Y*(BET+MSPACE+ SPACE+F_LDAT(IM-_PK))
XZ(1)=XBET+SPACE+F_LDAT(IM-LPK-1)
XZ(2)=XZ(1)+SPACE
XZ(3)=XZ(2)+SPACE
XZ(4)=XZ(3)+SPACE
99 DO 55 IK=1,4
56 YBE(IK)=BETAN(IM+IK-2)
BETAM(IM)=AITK(EV(XZ,YBE,XY,3))
GO TO 151
97 BETAM(LPK1)=0.5*(BETAN(LP1)+BETAN(-PK))
GO TO 151
98 BETAM(-PK)=0.5*(BETAN(-PK)+BETAN(-PK+1))
GO TO 151
51 BETAM(1)=0.5*(BETAN(1)+BETAV(2))
GO TO 151
55 BETAM(LPM1)=0.5*(BETAN(LPM1)+BETAN(LPM))
151 CONTINUE
50 CONTINUE
IF(ITERA.EQ.1) GO TO 5
51 I=1,-PM
41 BETAN(IE)=BETAN(IE)*(1.-XXM)+BETA0(IE)*XXM
52 IFG=1,LPM1
42 BETAM(IFG)=BETAM(IFG)*(1.-XXM)+BETA10(IFG)*XXM
53 IFG=1,LPM41
425 BETAV2(IFG)=BETAV2(IFG)*(1.-XXM)+BETA02(IFG)*XXM
54 IRP=1,6
352 SXSI(IRP)=SXSI(IRP)*(1.-XXM)+SXSI0(IRP)*XXM
5 ITERA=ITERA+1
IF(ITERA.GT.MSTDP) GO TO 28
GO TO 160
28 WRITE(5,29)
29 FORMAT(5X,26HITERATION # AS TERMINATED.)
339 CONTINUE
STOP
END

```

**

```

SJEROUTINE DZFNE(X,STOL,M,I,DG+DF,FFF4)
DIMENSION F(6),P(50,5),X(5),I(6,6),XRI(6),XM1(6)
COMMON/DE_TAD/DELT(S,S)
COMMON/FRECAV/XFRED,YFRED
COMMON/YCCC,SBETA2
COMMON XITC(200),XITN(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCA/-P44,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON FLAPN,DELTA,DPAP,ALFA1,GAMMA
COMMON SIGMA,SBETA,XXM,ICPI,SARC0(513)
COMMON IDJ,XA,XB,XC,TANGEP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(5),CCC1,CLE,ERC,YY,XM,ITERA,SXSIO(5),SYSIO(5),YXS(5)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAV(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XZX
COMMON XROUND,A2AA,B2BB,CCCC,A8,B8,C8,D8,TGAUS(100),FGAUS(100),NGAUS
PAI=3.141592653
I=0
IF(ITERA.E.3) GO TO 272
DO 67 IJ=1,6
57 WRITE(5,65) IJ,X(IJ)
66 FORMAT(1X,2H4(,I1,24)=,E14.7)
272 CONTINUE
55 SI1=2.*DE
SI5=2.*DG
IF(X(1).LT.SI1) X(1)=SI1
SI1=X(1)+2.*DG
IF(X(2).LT.SI10) X(2)=SI10
SI10=X(2)+2.*DG
IF(X(3).LT.SI11) X(3)=SI11
IF(Y(4).LT.SI5) X(4)=SI5
SI5=(0.5*PAI-GAMMA)*(1.-0.22)
IF((5).LT.G.) GO TO 75
IF(X(5).GT.SI5) X(5)=SI5
53 GO TO 79
78 IF(ABS(X(5)).GT.SI5) X(5)=-SI5
79 CONTINUE
IF(X(5).LE.0.) WRITE(5,112)
DO 56 IJ=1,6
53 WRITE(5,65) IJ,X(IJ)
IJ=1
-----F(1)-----
DO 20 IK=1,6
20 YXS(IK)=X(IK)
5 CONTINUE
55 CONTINUE
  <CTRL = 1
CALL F1INT_(YINT1,<CTRL)
SUBROUTINE F1INTL CALCULATES THE INTEGRALS IN F(1).
<CTRL = 2
CALL F1INTL (YINT2,<CTRL)
<CTRL = 3
CALL F1INT_ (YINT3,<CTRL)
<CTRL = 4
CALL F1INT_ (YINT4,<CTRL)
CS1=ALOG(COS(YXS(5))+GAMMA)/COS(ALFA1+GAMMA)+YXS(6)
      )AMMAG+1AFLA(SOC/AMMAG+5(SXY(SDC(GOLA = 1SC
FA = -(YINT1/PAI+YINT2-(CCC1+CS1/PAI)*YINT3
1+YINT4/PAI-YXS(5))
      +TINY+3TINY+2TINY+1TINY )/07.56 EFLR )1.0E.JI( FI

```

```

    ) ) X2,7+1E(4,----ERA ) 11F ED 4I,3I,2I,1I----,XC1< TA1R0F 07
IF (IJ.EQ.1) F(1) = FA
IF (IJ.EQ.2) SD TO 3
IF (IJ.EQ.3) SD TO 4
IF (IJ.EQ.4) SD TO 320
IF (IJ.EQ.5) SD TO 321
IF (IJ.EQ.6) SD TO 322
IF (IJ.EQ.66) SD TO 3222
P(1,6) = -YINT3/(PAI*Y(5(6)))
P(1,5) = TAN(YXS(5)+GAMMA)*YINT3/PAI-1.
IJ = 2
YXS(1) = X(1)+DELT(1,1)
SD TO 5
3 F1P = -FA
IJ = 3
Y(3(1)) = X(1)+DELT(1,1)
SD TO 3
4 F1G = -FA
P(1,1) = (F1P-F1G)/(2.+DELT(1,1))
IJ = 4
YXS(1) = X(1)
YXS(2) = X(2)+DELT(1,2)
SD TO 5
320 F1P = -FA
YXS(2) = X(2)+DELT(1,2)
IJ = 5
SD TO 5
321 F1G = -FA
P(1,2) = (F1P-F1G)/(2.+DELT(1,2))
Y(3(2)) = X(2)
YXS(3) = X(3)+DELT(1,3)
IJ = 6
SD TO 6
322 F1P = -FA
IJ=6
YXS(3)=X(3)+DELT(1,3)
SD TO 5
3222 F1G=-FA
P(1,3) = (F1P-F1G)/(2.+DELT(1,3))
P(1,4) = 0.
-----F(2) AND F(3)-----
DO 30 I4=1,6
30 YXS(I4)=X(I4)
IJ = 7
330 CONTINUE
KXXX=4.DG(COS(A_FA1+3444MA)/COS(YXS(5)+GAMMA)/YXS(6))
      ) ) A***AG+15(SYY(SCC/)A***AG+1AFLA(SCC(GOLA = XXXX
XX1 = YXS(4)+SIN(DS_TA)
YY1 = YXS(4)+COS(DS_TA)
YY12=YY1**2
CCY1 = CCC1-KXXX/PAI
XRP = 0.
XMM = 0.
DO 331 MIG = 1,4
331_ RMINF(SOLVR,SD_V4,MIG)
XRR1(MIG) = SOLVR
XMM1 (MIG) = SOLVM
XRR2 = -XRR1(MIG)/PAI
XMMM = -XMM1(MIG)/PAI
IF (MIG.EQ.1) XRR2 = CON1*XRR1(MIG)

```

```

IF (MIG.EG.1) X444 = CON1*X44I(MIG)
IF (MIG.EG.4) X222 = -XRR1(MIG)
IF (MIG.EG.4) X444 = -X44I(MIG)
    )4+1=I,)I(IIRR(X )17+5( ETIRb )7.GE.JI( FI
    )4+1=I,)I(I44X( )27+5( ETIRb )7.GE.JI( FI
))X2+7.41E(4,----ERA )3(F DNA )2(F FO 4,1=I,)I(IIRR(X---,X01(TAMRCF 17
))X2+7.41E(4,----ERA )3(F DNA )2(F FO 4,1=I,)I(I44X---,X01(TA4RCF 27
XRR = XRR+XRRR
X44 = X44+X444
351 CONTINUE
-----CALCULATION OF M1(ZETA1)-----
XSIP1 = XX1+1.
XSIMB = XX1-YXS(1)
XSIMF = XX1-YXS(3)
XSIMC = XX1-YXS(2)
XSIP12 = XSIP1**2
XSIMB2 = XSIMB**2
XSIMF2 = XSIMF**2
XSIMC2 = XSIMC**2
RRA = SGRT(XSIP12*YY12)
RRB = SGRT(XSIMB2*YY12)
RRC = SGRT(XSIMF2*YY12)
RRD = SGRT(XSIMC2*YY12)
THIA = ATAN(YY1/XSIP1)
IF (XSIP1.LE.0.) THIA = PAI+THIA
THIB = ATAN(YY1/XSIP1)
IF (XSIMB.LE.0.) THIB = PAI+THIB
THIC = ATAN(YY1/XSIMF)
IF (XSIMF.LE.0.) THIC = PAI+THIC
THID = ATAN(YY1/XSIMC)
IF (XSIMC.LE.0.) THID = PAI+THID
RR1 = SGRT(RRA*RRB*RRC/RRD)
THIT1 = .5*(THIA+THIB+THIC-THID)
COTH1 = COS(THIT1)
SITH1 = SIN(THIT1)
E2CD = RR1*(XRR*COT1-X44*SITH1)-4L=A1
E3CD = RR1*(XRR*SITH1+X44*COT1)+X<<X
IF (IJ.EG.7) F(2) = -E2CD
IF (IJ.EG.7) F(3) = -E3CD
IF (IJ.EG.8) G0 T0 340
IF (IJ.EG.9) G0 T0 341
IF (IJ.EG.10) G0 T0 342
IF (IJ.EG.11) G0 T0 343
IF (IJ.EG.12) G0 T0 344
IF (IJ.EG.13) G0 T0 345
IF (IJ.EG.14) G0 T0 346
IF (IJ.EG.15) G0 T0 347
TA2G = TAN(YXS(5)+3444A)
XSXC = XRR1(1)*SITH1+X44I(1)*COTH1
XCXS = XRR1(1)*COT1-X44I(1)*SITH1
P(2,5) = -RR1+TA2G*XCS
P(2,5) = P(2,5)/PAI
P(3,5) = -RR1+TA2G*XSXC
P(3,5) = P(3,5)/PAI+TA2G
P(2,6) = RR1*XCXS/(PAI+YXS(5))
P(3,6) = RR1*XSC/(PAI+YXS(5))-1./YXS(6)
IJ = 3
YXS(1) = x(1)+DELT(1,2)
G0 T0 330
340 E02 = E2CD

```

```

F23 = F3C0
IJ = 9
YXS(1) = X(1)-DELT(2,1)
5) TO 330
3+1 P(2,1) = (FP2-F2C0)/(2.+DELT(2,1))
P(3,1) = (FP3-F3C0)/(2.+DELT(2,1))
YXS(1) = X(1)
YXS(2) = X(2)+DELT(2,2)
IJ = 10
5) TO 330
3+2 FP2 = F2C0
FP3 = F3C0
YXS(2) = X(2)-DELT(2,2)
IJ=11
5) TO 330
3+3 P(2,2) = (FP2-F2C0)/(2.+DELT(2,2))
P(3,2) = (FP3-F3C0)/(2.+DELT(2,2))
YXS(2) = X(2)
YXS(3) = X(3)+DELT(2,3)
IJ = 12
5) TO 330
3+4 FP2 = F2C0
FP3 = F3C0
YXS(3) = X(3)-DELT(2,3)
IJ = 13
5) TO 330
3+5 P(2,3) = (FP2-F2C0)/(2.+DELT(2,3))
P(3,3) = (FP3-F3C0)/(2.+DELT(2,3))
YXS(4) = X(4)+DELT(2,4)
YXS(3)=X(3)
IJ=14
5) TO 330
3+6 FP2=F2C0
FP3=F3C0
YXS(4) = X(4)-DELT(2,4)
IJ = 15
5) TO 330
3+7 P(2,4) = (FP2-F2C0)/(2.+DELT(2,4))
P(3,4) = (FP3-F3C0)/(2.+DELT(2,4))
YXS(4)=X(4)
-----=(4)-----
IJ=16
YXS(1)=X(1)+DELT(4,1)
139 CALL DFSIM2(ANS2)
IF((IJ.EQ.1)) GO TO 575
IF((IJ.EQ.15)) GO TO 513
IF((IJ.EQ.17)) GO TO 514
IF((IJ.EQ.19)) GO TO 515
IF((IJ.EQ.20)) GO TO 516
IF((IJ.EQ.21)) GO TO 517
IF((IJ.EQ.22)) GO TO 518
IF((IJ.EQ.23)) GO TO 521
IF((IJ.EQ.24)) GO TO 522
IF((IJ.EQ.25)) GO TO 523
IF((IJ.EQ.26)) GO TO 524
IF((IJ.EQ.261)) GO TO 525
IF((IJ.EQ.262)) GO TO 526
513 ANSP=ANS2
IJ=17
YXS(1)=X(1)-DELT(4,1)

```

```

      GO TO 159
514 AVS2=AVS2
IJ=18
P(4,1)=-(AVSP-ANS2)/(2.*DELT(4,1))
YXS(1)=X(1)
GO TO 199
515 AVSF=AVS2
F(4)=-B1SS-ANSF
IJ=19
YXS(2)=X(2)+DELT(4,2)*AESS(X(2))
GO TO 199
515 AVSPP=ANS2
IJ=20
YXS(2)=X(2)-DELT(4,2)*AESS(X(2))
GO TO 199
515 AVS22=AVS2
IJ=21
YXS(2)=X(2)-DELT(4,2)*AESS(X(2))
IJ=21
YXS(3)=X(3)+DELT(4,3)*X(3)
GO TO 199
517 AVS1P=ANS2
IJ=22
YXS(3)=X(3)-DELT(4,3)*X(3)
GO TO 199
518 AVS1Q=AVS2
P(4,3)=-(AVS1P-ANS11)/(2.*DELT(4,3)*X(3))
YXS(3)=X(3)
IJ=23
YXS(4)=X(4)+DELT(4,4)*ABSS(X(4))
GO TO 199
521 AVA=AVS2
IJ=24
YXS(4)=X(4)-DELT(4,4)*ABSS(X(4))
GO TO 199
522 AVB=AVS2
P(4,4)=-(AVA-ANB)/(2.*DELT(4,4)*ABSS(X(4)))
YXS(4)=X(4)
IJ=25
YXS(5)=X(5)+DELT(4,5)
GO TO 199
523 BN4=AVS2
IJ=26
YXS(5)=X(5)-DELT(4,5)
GO TO 199
524 BN5=AVS2
P(4,5)=-(BN4-BN3)/(2.*DELT(4,5))
YXS(5)=X(5)
FFF4=F(4)
YXS(5)=X(5)
IJ=251
YXS(6)=X(5)+DELT(4,6)
GO TO 199
525 BNA=AVS2
YXS(6)=X(5)-DELT(4,6)
IJ=262
GO TO 199
526 BN6=AVS2
P(4,6)=-(BNA-BN3)/(2.*DELT(4,6))
YXS(6)=X(5)

```

```

C F(5) AND F(6)
C FIRST CALCULATE THE PHYSICAL COORDINATES
C FOR THE END POINT OF CAVITY.
C THIS SUBROUTINE FINDS THE END POINT OF CAVITY.
IJ = 27
315 CALL CAVITY (XCEND,YCEND)
C THEY FIND S2- THE ARC LENGTH OF THE SECOND WETTED PORTION.
C CALL SUBROUTINE ARCS2 FOR THIS PURPOSE.
I= (IJ,EG,27) YFREED=YCEVD
I= (IJ,EG,27) XFREED=XCEVD
      )6,I=I,(SXY(,JVECX,JI )035,6(ETIRW
      ))5.21E,X2(5,X5+5.21E,X5,3I,X1(TA4RC= 035
C CALL ARCS2 (S2,XCEND,YCEND)
C F(6)=YCEND=FUNCTION(XCEVD)=0 TO BE SATISFIED.
IS1I2=3
CALL SHAPE(XCEND,YUPPER,BETA,IS1I2)
WRITE(6,533) XCEND,S2,YUPPER
533 FORMAT(5X,*XCEND=*,E12.5,5X,*S2=*,E12.5,EX,*YUPPER=*,E12.5)
I=(IJ,EG,27) S15S2=S2
C FINALLY GO INTO F(5) COMPUTATIONS.
CALL JFSI45(ANSS)
IF(IJ,EG,27) GO TO 322
IF(IJ,EG,28) GO TO 321
IF (IJ,EG,29) GO TO 322
IF (IJ,EG,30) GO TO 323
IF (IJ,EG,31) GO TO 324
IF (IJ,EG,32) GO TO 325
IF (IJ,EG,33) GO TO 326
IF (IJ,EG,34) GO TO 327
IF (IJ,EG,341) GO TO 337
IF (IJ,EG,35) GO TO 323
IF (IJ,EG,36) GO TO 329
IF (IJ,EG,37) GO TO 332
IF (IJ,EG,38) GO TO 333
320 F(5) = -(S2-ANSS)
F(5) = -(YCEND-YUPPER)
IJ = 29
YXS(1) = X(1)+DELT(5,1)
GO TO 815
321 ANP = ANSS-S2
ANP6 = YCEND - YUPPER
IJ = 29
YXS(1) = X(1)-DELT(5,1)
GO TO 315
322 P(5,1) = -(ANP-(ANSS-S2))/(2.*DELT(5,1))
ANSS = YCEND-YUPPER
P(5,1) = (ANP6 - ANSS)/(2.*DELT(5,1))
YXS(1) = X(1)
YXS(2) = X(2)+DELT(5,2)*ABS(X(2))
IJ = 30
GO TO 815
323 ANP = ANSS-S2
ANP6 = YCEND-YUPPER
YXS(2) = X(2)-DELT(5,2)*ABS(X(2))
IJ = 31
GO TO 815
324 P(5,2) = -(ANP-(ANSS-S2))/(2.*DELT(5,2)*ABS(X(2)))
ANSS = YCEND-YUPPER
P(5,2) = (ANP6 - ANSS)/(2.*DELT(5,2)*ABS(X(2)))
YXS(2) = X(2)

```

```

IJ = 32
YXS(3) = X(3)+DELT(5,3)*X(3)
GO TO 815
325 ANP = ANS5-S2
ANPS = YCEND - YUPPER
YXS(3) = X(3)-DELT(5,3)*X(3)
IJ = 33
GO TO 815
326 P(5,3) = -(ANP-(ANS5-S2))/(2.+DELT(5,3)*X(3))
ANQ6 = YCEND - YUPPER
P(5,3) = (ANPS - ANQ6)/(2.+DELT(5,3)*X(3))
IJ = 34
YXS(3) = X(3)
YXS(4) = X(4)+DELT(5,4)*ABS(X(4))
GO TO 815
327 ANP = ANS5-S2
ANQ6 = YCEND - YUPPER
YXS(4) = X(4)-DELT(5,4)*ABS(X(4))
IJ=341
GO TO 315
330 CONTINUE
P(5,4) = -(ANP-(ANS5-S2))/(2.+DELT(5,4)*ABS(X(4)))
ANQ6 = YCEND - YUPPER
P(5,4) = (ANPS - ANQ6)/(2.+DELT(5,4)*ABS(X(4)))
YXS(4) = X(4)
YXS(5) = X(5)+DELT(5,5)
IJ = 35
GO TO 815
328 ANP = ANS5-S2
ANPS = YCEND-YUPPER
YXS(5) = X(5)-DELT(5,5)
IJ = 35
GO TO 815
329 P(5,5) = -(ANP-(ANS5-S2))/(2.+DELT(5,5))
ANQ6 = YCEND - YUPPER
P(5,5) = (ANPS - ANQ6)/(2.+DELT(5,5))
YXS(5)=X(5)
YXS(6)=X(6) + DELT(5,6)
IJ= 37
GO TO 815
332 ANP = ANS5 - S2
ANPS = YCEND - YUPPER
YXS(6) = X(6) - DELT(5,6)
IJ= 38
GO TO 315
333 P(5,6) = -(ANP -(ANS5 - S2))/(2.+DELT(5,6))
ANQ6 = YCEND - YUPPER
P(5,6) = (ANPS - ANQ6)/(2.+DELT(5,6))
YXS(6) = X(6)
DO 565 IK=1,6
555 WRITE(5,557)(P(IK,J),J=1,6)
557 FORMAT(3Y,*3(I,J)=+3(E14.7,2X))
558 WRITE(5,251) BIGS2,*CCCC,YCCC
251 FORMAT(20X,*BIGS2=*F10.5,2X,*CCCC=*,F10.5,2X,*YCCC=*,F10.5)
559 NCAV1=NCAV1+1
560 253 ICV=1,NCAV1+2
253 WRITE(5,252) CAVX(ICV),CAVY(ICV)
252 FORMAT(10X,*CAVX=*,F10.5,5X,*CAVY=*,F10.5)
561 129 ITX=1,6
129 WRITE(5,131) ITX,*ITX

```

```

131 F0RMA7(1X,2Hf(,I1,24)=,E14.7)
    DD 132 IUP=1,6
    IF(IITERA.E.3) GO TO 385
    DD 132 IUJ=1,6
132 WRITE(6,133) IUP,IUJ,P(IUP,IUJ)
133 F0RMA7(1X,24P(,I1,14,,I1,24)=,E14.7)
335 CONTINUE
    CALL DETERM(P,6,DET30)
    DD 25 IDET=1,6
    DD 26 LPG=1,6
    Q(LPG,IDEF)=P(LPG,IDEF)
26 P(LPG,IDEF)=F(LPG)
    CALL DETERM(P,6,DETE)
    IF(IDEF.E2.1) DEL_B=DETE/DET30
    IF(IDEF.EQ.2) DELC=DETE/DET30
    IF(IDEF.E2.3) DELD=DETE/DET30
    IF(IDEF.E2.4) DELE=DETE/DET30
    IF(IDEF.E2.5) DELF=DETE/DET30
    IF(IDEF.E2.6) DELG=DETE/DET30
    DD 27 PG=1,6
27 P(LPG,IDEF)=Q(LPG,IDEF)
28 CONTINUE
    X(1)=X(1)+DEL_B
    X(2)=X(2)+DEL_C
    X(3)=X(3)+DEL_D
    X(4)=X(4)+DEL_E
    X(5)=X(5)+DEL_F
    X(6) = X(6) + DEL_G
    DD 60 LMN=1,6
50 WRITE(6,51) LMN,X(LMN)
51 F0RMA7(1X,24X(,I1,24)=,E14.7)
    ABSB=ABS(DEL_B/X(1))
    ABS_C=ABS(DEL_C/X(2))
    ABS_D=ABS(DEL_D/X(3))
    ABS_E=ABS(DEL_E/X(4))
    ABS_F=ABS(DEL_F/X(5))
    ABS_G = ABS(DEL_G/X(6))
    KEIO=0
    IF(ABSB.LT.STOL) KEIO=1
    IF(ABS_C.GT.STOL) KEIO=0
    IF(ABS_D.GT.STOL) KEIO=0
    IF(ABS_E.GT.STOL) KEIO=0
    IF(ABS_F.GT.STOL) KEIO=0
    IF(ABS_G.GT.STOL) KEIO=0
    IF(KEIO.E2.1) GO TO 35
    I=I+1
    WRITE(6,42) I
42 F0RMA7(20X,144ITERATION NO.=,I2)
    IF(I.E2.4) GO TO 35
    GO TO 55
35 IF(I.E2.6) GO TO 36
    GO TO 38
36 WRITE(6,37)
37 F0RMA7(1X,34HOYFNE. DID NOT CONVERGE WITHIN IT)
    IF(X(1).LT.SI1) X(1)=SI1
    SI1U=(X(1)+2.*DG
    IF(X(2).LT.SI10) X(2)=SI10
    SI1L=X(2)+2.*DG
    IF(X(3).LT.SI11) X(3)=SI11
    IF(X(4).LT.SI16) X(4)=SI16

```

```
SI5=(0.5*PAI-GAMMA)*(1.-0.02)
IF(X(5).LT.0.) GO TO 31
IF((X(5).GT.SI5) X(5)=SI5
GO TO 82
31 IF(TAB(X(5)).GT.SI5) X(5)=-SI5
32 CONTINUE
IF (X(5).EQ.0.) WRITE(6,1122)
1122 FORMAT(2X,-----,(*5) BECAME LESS THAN ZERO -----)
33 RETURN
END
```

**

```

SUBROUTINE DFSIM1(ANS,NOF,XCA)
DIMENSION XST(6)
COMMON YCCC,SBETA2
COMMON XITM(200),XITN(200),AVSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCA/,LPW4,NB2
COMMON AJ(100),ISHAR,PNCHEY,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON F_LPAV,DELT,A,DGAP,A_FA1,G444
COMMON SIGMA,SBETA,XXM,IGR1,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,E2,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSV(6),CCC1,CLE,ERC,YYY,XM,ITERA,SXSIO(6),SYSIO(6),YXS(6)
COMMON PSIZ,LP,SARC(513),SARC0(513),_P4,DI
COMMON BETAM(513),BETAM(513),IJ,LPK,KII(200),KJJ(200),XJX
COMMON XRDIVD,A2AA,B2BB,C2CC
COMMON AAAA,B3B3,CCC3,AB,BB,CB,TSGAUS(100),NGAUS(100),NGAUS
NOF = 0 CALLED FROM FINIT.
NOF = 1 CALLED FROM RMINT FOR REAL PART.
NOF = 2 CALLED FROM RMINT FOR IMAG. PART.
NOF = 3 CALLED FROM CAVITY DIVER AT F(E)
IF (I>PI,EG,0) GO TO 9
DO 10 IG = 1,6
10 XST(IG) = XSN(IG)
GO TO 12
9 DO 11 IH = 1,6
11 XST(IH) = YXS(IH)
12 CONTINUE
IF(ITERA>=2,1) GO TO 222
GO TO 223
222 DO 224 IL(<= 1,-24
224 BETAM(ILK) = SBETA
223 CONTINUE
CSPACE = (1.+XST(1))/F_LDAT(_PK)
=SPACE = CSPACE/F_LDAT(_PK-2)
_P43=_P4+3
XBET = -1.*CSPACE+F_LDAT(_PK-1)
XSI1=-1.*CSPACE
BE1 = BETAN(2)
AP1 = (XSI1-XST(2))/((XSI1+1.)*(XST(1)-XSI1)*(XSI1-XST(3)))
AP1S = SGRT(AP1)
=F3 = BE1*AP1S
XX1 = XST(3)*SIN(DE_T4)
YY1 = XST(4)*COS(DE_T4)
YY12 = YY1**2
PLM = XSI1 -XX1
_P42 = PLM**2
PLMA = PLM2*YY12
PXR = PLM/PLMA
PSI = YY1/PLMA
IF(NOF,EG,1) F3 = F3*PXR
IF(NOF,EG,2) F3 = F3*PSI
IF(NOF,EG,3) F3=F3/(XSI1-XCA)
AVSA=0.
DO 1 I = 2,-P43,2
=F1 = F3
SPACE = CSPACE
I= (I>E,LPK) GO TO 30
XSI2 = -1.*SPACE=F_LDAT(I)
XSI3 = XSI2+SPACE
GO TO 31
30 SPACE = FSPACE
XSI2 = XBET+SPACE=F_LDAT(I-_P4+1)

```

```

XSI3 = XSI2+SPACE
31 BE2 = BETAV(I+1)
BE3 = BETAV(I+2)
AP2 = (XSI2-XST(2))/((XSI2+1.)*(XST(1)-XSI2)*(XSI2-XST(3)))
AP3 = (XSI3-XST(2))/((XSI3+1.)*(XST(1)-XSI3)*(XSI3-XST(3)))
AP2S = SQRT(AP2)
AP3S = SQRT(AP3)
F2 = BE2*A2S
F3 = BE3*A3S
HA2 = XSI2-XX1
HA22 = HA2**2
HB = HA22*YY12
HCR2 = HA2/HB
HCl2 = YY1/HB
HA3 = XSI3-XX1
HA32 = HA3**2
HD=HA32*YY12
HCR3 = HA3/HD
HCl3 = YY1/HD
IF(NOF.EQ.1) F2 = F2*HCR2
IF(NOF.EQ.1) F3 = F3*HCR3
IF (NOF.EQ.2) F2 = F2*HCl2
IF(NOF.EQ.2) F3 = F3*HCl3
IF (NOF.EQ.3) F2 = F2/(XSI2-XCA)
IF(NOF.EQ.3) F3 = F3/(XSI3-XCA)
FSUM = (F1+F2+F3)*SPACE/3.
ANSA = ANSA+FSUM
1 CONTINUE
SQ1 = SQRT((-1.-XST(2))/(-1.-XST(3)))
SQ2 = SQRT(XST(1)+1.)
SQ3 = SQRT((XST(1)-XST(2))/(XST(1)-XST(3)))
ANT1 = BETAN(1)*2.*SQRT(CSPACE)*SQ1/SQ2
ANT2 = BETAV(LP4)*2.*SQRT(FSPACE)*SQ3/SQ2
APLA = -1.-XX1
APLA2 = AP_A**2
APL5 = XST(1)-XX1
APLB2 = APLB**2
IF(NOF.EQ.1) ANT1 = ANT1*AP_A/(AP_A2+YY12)
IF (NOF.EQ.1) ANT2 = ANT2*APLB/(APLB2+YY12)
IF (NOF.EQ.2) ANT1 = ANT1*YY1/(AP_A2+YY12)
IF (NOF.EQ.2) ANT2 = ANT2*YY1/(APLB2+YY12)
IF (NOF.EQ.3) ANT1 = ANT1/(-1.-XCA)
IF (NOF.EQ.3) ANT2 = ANT2/((XST(1)-XCA)
ANS = ANSA+ANT1+ANT2
RETJRV
END

```

```

SUBROUTINE DFSIM2(AVS2)
DIMENSION X(3),XIT(3),YY(3),XITC(3),EXU(3),FCN3(3),XST(6)
COMMON YCCC,SBETA2
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NIAV,PMM,VS2
COMMON AJ(100),ISHTAP,VCHBY,BETAV(100),BBTAV2(100),BETAV2(100)
COMMON FLAPAN,DELTA,J3AP,ALFA1,GAMMA1
COMMON SIGMA,SBETA4,ICP1,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,EYC,YR,JBIGS,XLB1SS,BIGS,SMALS,CSS
COMMON XSV(6),CCC1,EE,ERC,YYY,X4,ITERA,SXS1D(6),SXS1D(6),YXS(6)
COMMON PSIZ,LPM,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAV(513),IJ,LPK(XII(200),KJJ(200),XDX
COMMON XRDJD,A2AA,3233,C2CC
COMMON AAAA,BBBS,CCC+A8+B8,CS+D8,TGAUS(100),NGAUS(100)
DO 13 IS=1,6
13 XST(IS)=YXS(IS)
PAI=3.141592653
JJ2=COS(A_FA1+GAMMA)/COS(XST(5)+GAMMA)/XST(5)
                )AMMAG+TSX(SOC)AMMAG+1AFIA(SOC=2UJ
      *****ALOG(JJ2)
CSPACE=(1.+XST(1))/FLDAT(_PK)
CSPACE=G_5*CSPACE
FSPACE=CSPACE/FLDAT(_PM-LPK)
FSPACE=G_5*FSPACE
XBET=-1.+CSPACE*FLDAT(_PK-1)
CDE=COS(DETA)
SDE=SIN(DETA)
GA=XST(1)-XST(4)*SDE
GB=XST(4)*CDE
PPP=CDE/(GA**2+GB**2)
FCV3(3)=DGAP*PPP*XST(1)/(PAI+SQRT(1.+SIGMA))
LPKI=LPK-LPK+1
DO 1 IP=1,LPM
IF(IP.EQ.1) GO TO 2
HSPACE=HSPACE
SPACE=FSPACE
IF(IP.GT.LPKI) GO TO 30
X(1)=XST(1)-SPACE*FLDAT(IP-2)
X(2)=X(1)-4SPACE
X(3)=X(1)-SPACE
GO TO 31
30 HSPACE=HSPACE
SPACE=CSPACE
X(1)=XBET-SPACE*FLOAT(IP-LPKI-1)
X(2)=X(1)-4SPACE
X(3)=X(1)-SPACE
51 FCN3(1)=FCN3(3)
NK=3
IF(IP.EQ.LPM) NK=2
DO 5 I=2,NK
IF(IJ.GE.23) GO TO 3
GO TO 7
3 IF(I.EQ.2) XIT(2)=XIT4(LPM-IP+1)
IF(I.EQ.3) XIT(3)=XITV(LPM-IP+1)
GO TO 5
7 CONTINUE
YY(I)=X(I)
C 0=SIM3 CALCULATE G1 .
CALL 0=SIM3(YY(I),XITC(I),IP,I)
XIT(I)=XITC(I)

```

```

      IF(IJ.EQ.13) GO TO 5
      GO TO 5
5   IF(I.EQ.2) XITM(LP4-IP+1)=XIT(I)
      IF(I.EQ.3) XITV(LP4-IP+1)=XIT(I)
5   CONTINUE
      EXJ(I)=EXP(-XIT(I))
      GC=X(I)-XST(4)*SDE
      GD=XST(4)*CDE
      PAZ=3**2*3)**2
      DDX=DGAP*x(I)*CDE/(PAZ*PAI)
      FCN3(I)=EXJ(I)*DDX/JJ2
      IF((I).LE.0.) FCN3(I)=-FCN3(I)
5   CONTINUE
C  CHECK IF FCN3(I) IS ALWAYS POSITIVE.
      IF(IP.EQ..PM) GO TO 20
      GO TO 21
20  PG=CDE/((-1.-XST(4)*SDE)**2+(XST(4)*CDE)**2)/JJ2
    ZZ=3=DGAP*PAZ/PAI
    FCN3(3)=ZZ
21  SJ=(FCN3(1)+FCN3(2)*4.+FCN3(3))*4*PACE/3.
    ANS2=ANS2+SUM
    IF(IJ.EQ.13) SARC(LP4-IP+1)=ANS2
    GO TO 1
2   SARC(LP4)=0.
    ANS2=0.
1   CONTINUE
C  XITV(-P4)=G1 AT POINT 5.
C  XINT(1)=G1 AT POINT Y=1.
    XITV(-P4)=CCCC1-XKKK/PAI
    XITV(1)=0.
    RETJRV
    END

```

**

```

SUBROUTINE DFSIM3(Y,((II,ISI),I)
DIMENSION XST(6),FX_S(100),FA(200)
COMMON YCCC,S3ETA2
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,-PM4,V$2
COMMON AJ(100),ISHAR3,VCHBY,BETAV(100),BETAV2(100),BETAV3(100)
COMMON FLAPAN,DELTA,D3AP,ALFA1,GAMMA
COMMON SIGMA,S3ETA,((4,ICPI,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,EY,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(6),CCC1,LPE,ERC,YYY,XM,ITERA,SXSIO(6),SXSI0(6),YXS(6)
COMMON PSIZ+LP,SARC(513),SARC0(513),LP4,DE
COMMON BETAV(513),BETAV4(513),IJ,_P<,XII(200),YJJ(200),XDX
COMMON XRQUNO,A2A4,3233,C2CC
COMMON AAAA,BB55,CCC3,AB,BB,CB,DB,TGAUS(100),GAUS(100),NGAUS
FOUR INTEGRALS TO BE EVALUATED BEFORE XI IS OBTAINED.
NOTE THAT PREVIOUSLY ONLY ONE SINGULAR INTEGRAL WAS
CALCULATED IN SCASCA AND CASCADE.
SEE THE NOTE OF TC 3951 FOR FOUR INTEGRALS, OUT OF WHICH
TWO ARE OF SINGULAR TYPE.
IF(ICPI.EQ.0) GO TO 9
DO 11 ISI=1,6
11 XST(ISI)=XS(1)
GO TO 12
9 DO 13 JTJ=1,6
13 XST(JTJ)=YXS(JTJ)
12 PAI=3.141592653
-----FIRS I1-----
IF (ITERA.EQ.1) GO TO 60
GO TO 51
50 CONTINUE
50 52 IZU = 1,LP4
BETAN(IZU) = SBETA
BETAM(IZU) = SEETA
52 CONTINUE
51 CONTINUE
CSPACE=(1.+XST(1))/FLOAT(_P<)
MCSPACE=0.5*CSPACE
FSPACE=CSPACE/FLDAT(_P4-LP<)
NSPACE=0.5*FSPACE
XBET=-1.+CSPACE+FLOAT(_P<-1)
AB3=SQRT((XST(1)+Y)*(XST(1)-Y))
AB6 = SQRT((XST(3)+Y)/(XST(2)-Y))
AB3 = AB3*AB6
IJ2=_P4-IP+1
IJ3=1
IF(I.EQ.3) IJ3=_P4-1+1
IF(I.EQ.0) IJ3=1
BEC=BETAN(IJ3)
IF(I.EQ.2) BEC=BETAV(IJ2)
FAA=BEC/AB3
_P41=_P4-1
D0 1 IJ=2,_P41
SPACE=CSPACE
IF(IW.GT._P<) GO TO 45
XSK=-1.+SPACE*FLOAT(IW-1)
GO TO 46
45 SPACE=FSPACE
XSK=XBET+ SPACE*FLDAT(IW-LP<)
46 IF(I.EQ.2) GO TO 5

```

```

1 IF(I=EG+IJ3) GO TO 1
2 FS=SQRT((1.+XST(1))*(XST(1)-XSC()))
3 FSA1 = SQRT((XST(3)-XSC)/(XST(2)-XSC))
4 FS = FS*FSA1
5 FA(IW)=(BETAN(IW)/FS-FAA)/(XSC-Y)
6 CONTINUE
7 IF(I.EQ.2) GO TO 30
8 XP1=-1.0+HFS*PAC
9 XP2=XP1+CSPACE
10 XP4=XST(1)-1*FS*PAC
11 XP3=XP4-FSPAC
12 FS1=BETAM(1)/ SQRT((1.+XP1)*(XST(1)-XP1))
13 FS2=BETAM(2)/ SQRT((1.+XP2)*(XST(1)-XP2))
14 FS3=BETAM(-P4-2)/ SQRT((1.+XP3)*(XST(1)-XP3))
15 FS4=BETAM(-P4-1)/ SQRT((1.+XP4)*(XST(1)-XP4))
16 FSA1 = SQRT((XST(2)-XP1)/((XST(3)-XP1)))
17 FSA2 = SQRT((XST(2)-XP2)/((XST(3)-XP2)))
18 FSA3 = SQRT((XST(2)-XP3)/((XST(3)-XP3)))
19 FSA4 = SQRT((XST(2)-XP4)/((XST(3)-XP4)))
20 FS1 = FS1+FSA1
21 FS2 = FS2+FSA2
22 FS3 = FS3+FSA3
23 FS4 = FS4+FSA4
24 FP1=(FS1-FAA)/(YD1-Y)
25 FP2=(FS2-FAA)/(YD2-Y)
26 FP3=(FS3-FAA)/(YD3-Y)
27 FP4=(FS4-FAA)/(YD4-Y)
28 IF(IU3.EQ.2) GO TO 21
29 IF(IU3.EQ.-P41) GO TO 22
30 IF(IU3.EQ.-P4) GO TO 31
31 FA(IU3)=0.5*(FA(IU3-1)+FA(IU3+1))
32 GO TO 30
33 BETO=2.0*BETAN(LPK)-BETAN(LPK+1)
34 XDA=XBET-FSPACE
35 FP_d=BETO/SQRT((1.+XDA)*(XST(1)-XDA))
36 FP_dA = SQRT((XST(2)-XDA)/(XST(3)-XDA))
37 FP_dA=FPA
38 F_d=(FP_d-FAA)/(XDA-Y)
39 FA(IJ3)=0.5*(FA(IJ3+1)+FP_d)
40 GO TO 30
41 FA(IU3)=(FP1+FP2)/2.
42 GO TO 30
43 FA(IU3)=(FP3+FP4)/2.
44 I=1
45 LPM3=-P4-2
46 SPACE=CSPACE
47 DO 15 JA=2,LPM3+2
48 I=JA+GE_-P4
49 SPACE=FSPACE
50 XI=XI+(FA(JA)*4.0*FA(JA+1)+FA(JA+2))*SPACE/3.
51 IF(I.EQ.2) GO TO 35
52 XI23=0.5*4*CSPACE*(FP1+FA(2))+(FA(LPM-1)+FP4)*0.5*4*FSPACE
53 X<I=41.
54 J=39
55 LPM4=LPM+5
56 I=IU3+GE_-PMA XKI=231.
57 IF(IU3.GE.-P44) IU=133
58 DZ=(BETA4(1)-BETA4(1))/X<I
59 DY=(BETA4(-P4)-BETA4(-P41))/X<I
60 HFF=HFS*PAC/XKI
61 F=HFS*PAC/XKI

```

```

FT3=FP1
FJ3=FP4
XI4=0.
XI1=0.
JJ 202 IT4=1,<J+2
FT1=FT3
FJ1=FJ3
XM2=xST(1)-HFSPAC+HFF+FLOAT(IT4)
X43=x42+HFF
XT2=-1.+HCSPAC-HFF+FLOAT(IT4)
XT3=XT2-M=F
BETA2=BETA4(LP41)+B3Y+FLOAT(IT4)
BETA3=BETA2+B0Y
BETT2=BETA4(1)-B02+FLOAT(IT4)
BETT3=BETT2-B02
FS2=BETA2/SQRT((1.+Y42)*(xST(1)-X42))
FS3=BETA3/SQRT((1.+Y43)*(xST(1)-X43))
FV2=BETT2/SQRT((1.+XT2)*(xST(1)-XT2))
FV3=BETT3/SQRT((1.+XT3)*(xST(1)-XT3))
FS2A = SQRT((xST(2)-X42)/(xST(3)-XM2))
FS3A = SQRT((xST(2)-X43)/(xST(3)-X43))
FV2A = SQRT((xST(2)-XT2)/(xST(3)-XT2))
FV3A = SQRT((xST(2)-XT3)/(xST(3)-XT3))
FS2 = FS2+FS2A
FS3 = FS3+FS3A
FV2 = FV2+FV2A
FV3 = FV3+FV3A
FJ2=(FS2-FAA)/(X42-Y)
FJ3=(FS3-FAA)/(X43-Y)
FT2=(FV2-FAA)/(XT2-Y)
FT3=(FV3-FAA)/(XT3-Y)
XI4=XI4+HFF+(FT1+FJ2+4.+FJ3)/3.
202 XI1=XI1+HFF+(FT1+FT2+4.+FT3)/3.
XA4=BETAN(LPM)+2.*SQRT(HFF)/(AB2*(xST(1)-Y))
XA4A = SQRT((xST(2)-xST(1))/(xST(3)-xST(1)))
XA4 = XA4*XA4A
XI4=XI4+XA4
KA1=BETAN(1)=2.*SQRT(4F4)/(AB2*(-1.-Y))
XA1A = SQRT((xST(2)+1.)/(xST(3)+1.))
KA1 = KA1*XA1A
XI1=XI1+XA1
XI=(XI+XI23+XI1+XI4)+B3/PAI
XI=XI+BEC*A_03((xST(1)-Y-4FF)/(1.+Y-4F4))/PAI
XXI1=-XI
30 TO 36
35 XR1=-1.+0.5*HCSPAC
XR2=XR1+HCSPAC
XR4=xST(1)-0.5+HFSPAC
XR3=XR4-HFSPAC
FT1=0.5*(BETAN(1)+BETA4(1))/ SQRT((1.+XR1)*(xST(1)-XR1))
FT2=0.5*(BETA4(1)+BETAN(2))/ SQRT((1.+XR2)*(xST(1)-XR2))
FT3=0.5*(BETAN(LP4-1)+BETA4(LP4-1))/ SQRT((1.+XR3)*(xST(1)-XR3))
FT4=0.5*(BETA4(LP4-1)+BETAN(LP4))/ SQRT((1.+XR4)*(xST(1)-XR4))
FT1A = SQRT((xST(2)-XR1)/(xST(3)-XR1))
FT2A = SQRT((xST(2)-XR2)/(xST(3)-XR2))
FT3A = SQRT((xST(2)-XR3)/(xST(3)-XR3))
FT4A = SQRT((xST(2)-XR4)/(xST(3)-XR4))
FT1 = FT1+FT1A
FT2 = FT2+FT2A
FT3 = FT3+FT3A

```

```

XIB=2.*SQRT(HSP61)*BETAN(1)/(A52*(-1.-Y))
XIBA = SQRT((XST(2)+1.)/(XST(3)+1.))
XIB = XIB*XIBA
XI1=XI1+XI3
XI=(XI+XI1+XI23+XI4)*AB3/PAI
XI=XI+BEC+A_DG((XST(1)-Y-4S^2S)/(1.+Y-HSP61))/PAI
XXI1=-XI
35 CONTINUE
-----I2-----
C-----IF Y IS LESS THAN ZERO, THIS IS A
C-----REGULAR INTEGRAL, WHILE Y .GE. 0, THIS IS A
C-----SINGULAR INTEGRAL.
C   BUT THIS IS TREATED AS A SINGULAR INTEGRAL ANYWAY
ISIC=3
XCA=Y
CA= IC2(SR,S4,XCA,ISIC)
XYI2=SR
ARGL=(XST(1) -Y)/Y
IF (ARGL.LT.0.) ARG_L=ARG_
XXI2=XXI2+A33+AL03(ARG_)
XXI2=-XXI2
-----I3-----
C   JSE CHEBYSHEV-GAUSS QUADRATURE.
C   AJ(I) ARE ALREADY CALCULATED IN SUBROUTINE F1INTL
C   AND PASSED ONTO HERE BY COMMON STATEMENT.
XXI3 = 0.
BPC5 = (XST(1)+XST(2))*0.5
CMBS = (XST(2)-XST(1))*0.5
A31 = (BPC5+1.)/CMBS
A32 = (-BPC5*XST(3))/CMBS
D0 120 ISJM = 1,NCHBY
HA1 = 1.-AJ(ISJM)
HA2 = (AJ(ISJM)+A31)*(A32-AJ(ISJM))
SHA2 = SQRT(HA2)
F3I3 = HA1/SHA2
F3AI3 = CMBS*AJ(ISJM)+BPC5-Y
120 XXI3 = XXI3+F3I3/F3AI3
XYI3 = XXI3*PAI/NCHBY
JJ22 = C05(ALFA1+GA14A)/COS(XST(5)+GA14A)/XST(6)
HX3 = CCC1-AL0G(UU22)/PAI
XXI3 = XXI3*A33-HX3
-----I4-----
C   JSE CHEBYSHEV-GAUSS QUADRATURE FORMULA---
C   BBET+N2(I) ARE ALREADY CALCULATED IN
C   SUBROUTINE F1INTL AND PASSED ONTO HERE BY
C   COMMON STATEMENT.
FPC5 = (XST(3)+XST(2))*0.5
FMCS = (XST(3)-XST(2))*0.5
A41 = (FPC5+1.)/FMCS
A42 = (FPC5-XST(1))/FMCS
XXI4 = 0.
D0 130 ISJM = 1,NCHBY
RAX = (BBET+N2(I)*PAI)*(1.+AJ(ISJM))
R3X = (AJ(ISJM)+A41)*(AJ(ISJM)+A42)
SRBX = SQRT(R3X)
RCX = RAX/SRBX
RDX = FMCS*AJ(ISJM)+FPC5-Y
130 XXI4 = XXI4 + RDX/RDX
XXI4 = XXI4*PAI/NCHBY
XXI4 = -XXI4*A33/PAI

```

```

FT4 = FT4+FT4A
FR1=(FT1-FAA)/(XR1-Y)
FR2=(FT2-FAA)/(XR2-Y)
FR3=(FT3-FAA)/(XR3-Y)
FR4=(FT4-FAA)/(XR4-Y)
XIP1=0.5*HCSpac*(FR1+FR2)+0.5*4*SPAC*(FR3+FR4)
XIP2=0.25*HCSpac*(FR2+FA(2))+0.25*H*SPAC*(FA(1,P4-1)+FR3)
XI23=XIP1+XIP2
X4I=21.
X4I2=42.
MU=21
M2=MU-2
_34A=_24-5
I=(IU2.GE.LPMA) X4I=101.
I=(IJ2.GE._34A) X4I2=202.
I=(IU2.GE.LPMA) MU=101
I=(IJ2.GE._34A) M2=1J-2
BETY=(BETAN(LPM)-BETA4(LP4-1))/X4I2
BESS=0.5*(BETAN(LPM)+BETA4(LP4-1))
HSP5=0.5*4*SPAC/X4I
F13=FR4
BETY1=(BETA4(1)-BETAN(1))/X4I2
BESS1=0.5*(BETAN(1)+BETAN(1))
HSP51=0.5*4*SPAC/X4I
F31=F13
X11=0.
X14=0.
DO 129 IL=1,M2,2
F31=FQ31
FQ11=FQ31
X2=XST(1)-HSP5+F_QDAT(1J-IL)
X3=X2+HSP5
X21=-1.+HSP51+F_QDAT(4J-IL)
X31=X21-HSP51
SETA2=BESS+BETY*FLOAT(IL)
BETA3=BESS+BETY1+F_QDAT(IL+1)
BETA21=BESS1-BETY1+F_QDAT(IL)
BETA31=BETA21-BETY1
FJ21=BETA21/SQRT((1.+X21)*(XST(1)-X21))
FJ31=BETA31/SQRT((1.+X31)*(XST(1)-X31))
FJ21A = SQRT((XST(2)-X21)/(XST(3)-X21))
FJ31A = SQRT((XST(2)-X31)/(XST(3)-X31))
FJ21 = FU21+FJ21A
FU31 = FU31+FJ31A
FJ21=(FU21-FAA)/(X21-Y)
FJ31=(FU31-FAA)/(X31-Y)
FJ2=beta2/SQRT((1.+X2)*(XST(1)-X2))
FJ3=beta3/SQRT((1.+X3)*(XST(1)-X3))
FJ2A = SQRT((XST(2)-X2)/(XST(3)-X2))
FJ3A = SQRT((XST(2)-X3)/(XST(3)-X3))
FU2 = FU2+FJ2A
FJ3 = FJ3+FJ3A
FQ2=(FU2-FAA)/(X2-Y)
FQ3=(FU3-FAA)/(X3-Y)
X11=XI1+4*SP51*(FQ11+FJ21*4.+FJ31)/3.
X14=XI4+HSP5*(FG1+4.+FQ2+FQ3)/3.
XIA=2.*SQRT(HSP5)*BETAN(LP4)/(AB2*(XST(1)-Y))
XIAA = SQRT((XST(2)-XST(1))/(XST(3)-XST(1)))
XIA = XIA*XIAA
XI4=XI4+XIA
129

```

```
XXII = XXI1+XXI2+XXI3+XXI4
      2=1TIR=I
      03=2TIR=I
      06=3TIR=I
PI,<%IXX, 3IXX,2IXX,1IXX )55,5(ETIR= )1TIR=I,01,>I,DNA,81,GE,JIC FI
PI,<%IXX, 3IXX,2IXX,1IXX )55,5(ETIR= )2TIR=I,01,PI,DNA,P1,CE,JIC FI
PI,<%IXX, 3IXX,2IXX,1IXX )55,5( ETIR= )3TIR=I,01,>I,DNA,51,GE,JIC FI
,X2,)X2,7,41E(4,---ERA )4(F FC 4I,3I,2I,1I---,X01( TA4RCF 55
)4I,0=PI=A

RETURN
END
```

```

SUBROUTINE DFSIM5(ANS5)
DIMEN$IDY S2SR(101),S2(101),(5)
COMMON YCC,SBETA2
COMMON XIT(200),XITV(200),AVSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMH,NS2
COMMON AU(100),IS1A2,YC4BY,BETAN(100),BETAV2(100),BETAV4(100)
COMMON FLAPN,DELTA,C3AP,A_FA1,GAMMA
COMMON SIG4A,SEETA,X4,ICPI,SARC00(513)
COMMON IDJ_XA,X3_X1,TANG,E2,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSN(5),CCC1,CLE,ERC,YYY,XM,ITERA,SXS10(6),SXSI0(6),YXS(6)
COMMON PSIZ,LPM,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),KJJ(200),XDX
COMMON XRQND,A2AA,B2BB,C2CC
COMMON AAA,BBBB,CCC1,A5,B5,C8,TGAUS(100),NGAUS
PAI=3.141592654
C THIS SUBROUTINE CALLED FROM DKEVNE.
C USE SIMPSON'S RULE.
DO 1 I=1,5
1 XST(IM0) = YXS(IM0)
CDE = COS(DELTA)
SDE = SIN(DELTA)
C VS2 SHOULD HAVE A FACTOR OF 4.
C VS2=-P44=-P42
VS21 = NS2+1
VS24 = NS2-1
S2GAP = (XST(3)-XST(2))/NS2
JJ2 = COS(A_FA1+GAMMA)/COS(XST(5)+GAMMA)/XST(5)
      )AMMAS+5(TSX(SDC/AMMAS+1AFLA(SCC = 20J
DO 2 IS2 = 1,VS21
XS2 = XST(2)+S2GAP*(IS2-1)
XCC = XS2+CDE
XMAS = XS2-XST(4)*SDE
XMAS2 = XMAS**2
ASD = XST(4)*CDE
ASD2 = ASD**2
DwDX = DGAP*X0/((X*AS2+ASD2)*PAI)
IF (IS2.E3.1) GO TO 3
IF (IS2.E3.VS21) GO TO 4
CALL S2 (XS2,ANSG2,IS2)
C G2 CALCULATES G2 WITH XSI GIVEN.
E62 = EXP(-ANSG2)
I=(IJ,EG,27) ANSG2S(IS2)=ANSG2
S2(IS2) = E62*DwDX/JJ2
GO TO 2
3 CONTINUE
S2(1) = DwDX/SQRT(1.+SIG4A)
ANSG2S(IS2)=ALOG(SQRT(1.+SIGMA)/UJ2)
GO TO 2
4 CONTINUE
S2(VS21) = DwDX/JJ2
AVSG2S(IS2)=0.
2 CONTINUE
S2SR(1) = 0.
DO 10 JS2 = 1,NS2A,2
10 S2SR(JS2+2) = S2SR(JS2)
1+(S2(JS2)+4.*S2(JS2+1)+S2(JS2+2))*S2GAP/3.
I=(IJ,EG,27) GG TO 40
SARC2(1)=0.
DO 50 ISARC=2,NS2,2
50 S2SR(ISARC)=.5*(S2SR(ISARC-1)+S2SR(ISARC+1))

```

DO 30 ISARC=1,NS21
30 SARC2(LSARC)=S2SR(LSARC)
+0 CONTINUE
AVSS = S2SR(NS21)
RETJRV
END

vv

```

SUBROUTINE IC2(SR,SM,XCA,ISIC)
DIMENSION X<ER1(100),<ER2(100),XST(6)
COMMON 1CCC,SBETA2
COMMON AIT1(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),ISHAR2,VCHBY,BBTAN(100),BBTAN2(100),BETAV2(100)
COMMON FLAP4V,DELT,A,DGAP,ALFA1,GAMMA1
COMMON SIGMA,SBETA,XXM,ICPI,SARC0(513)
COMMON IDJ_,XA,XB,XC,TANG,E,P,YC,YR,JBI3S,XLBIGS,BIGS,SMALS,DSS
COMMON XSNS(5),CCC1,CLE,ERC,YYY,XM,ITERA,SXS10(6),SXSI00(E),YXS(6)
COMMON PSIZ,L2,SARC(513),SARC0(513),L7M,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XOX
COMMON XRDJND,A2AA,3233,C2CC
COMMON AAAA,3398,CCCC,AS,BB,CB,DS,T3AUS(100),GAUS(100),NEAUS
DO 1 IPV = 1,6
1 XST(IPV) = YXS(IPV)
XX1 = XST(4)*SIN(DELT)
YY1 = XST(5)*COS(DELT)
YY12 = YY1**2
ISIC = 0 F0R RMINT
= 1 IN CAVITY OF DFSIMS FOR F(5) AND IN CAVITY.
2 CALLED FROM F1INT_ FOR F(1).
3 FOR IZ OF F(4).
SR=0.
SM=0.
B4=XST(1)**5
B4MC=B4-XST(2)
B4P1=B4+1.
B4MF=B4-XST(3)
B11=B4MC/34
B12=B4P1/BM
B13=B4MF/34
IF(ISIC.NE.3) GO TO 20
AP1=(XCA+1.)*(XST(1)-XCA)*(XCA-XST(3))
AP2=XCA-XST(2)
APS=SQR(AP1/AP2)
20 CONTINUE
DO 7 ISUM=1,NCHBY
RA=(AJ(ISJM)+B11)*(AJ(ISJM)+1.)
RB=(AJ(ISJM)+B12)*(AJ(ISUM)+B13)
SAB=SQR(RA/RB)
SAC=B4-SQRT(1.-AJ(ISJM)**2)/SAB
XSIP=B4*AJ(ISJM)+B4
XPX2=XSIP**2
XPX2=XPX2**2
RV2=XPX2*YY12
RWR=YPY2/RV2
RI=YY1/RV2
IF(ISIC.EQ.1) RWR=1./(XSIP-XCA)
IF(ISIC.EQ.2) RWR=1.
IF(ISIC.EQ.3) RWR=(1.-SAC/APS)/(XSIP-XCA)
SR=SR+SAB*RWR
7 SM=SM+SAB*RRI
PAI=3.141592654
SR=SR+PAI/VCHBY
SM=SM+PAI/VCHBY
RETURN
END

```

```

SUBROUTINE F1INTL(YINT,KCTRL)
DIMENSION XST(6),RJS(100)
COMMON YCCC,SBETA2
COMMON XITM(200),XITV(200),AVS02S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,N3AV+LPMM,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAN(100),BBTAN2(100),BETAV2(100)
COMMON FLAPAV,DELTA,D3AP,A_FA1,GA441
COMMON SIGMA,SBETA,XX4,ICPI,SARC0(513)
COMMON IDJ,XA,XB,XC,TANG,E,YC,YR,BIGS,XL3I3S,BIGS,SMALS,DSS
COMMON XSN(6),CCC1,CLC,ERC,YYY,XM,ITERA,SXSID0(6),SXSID0(E),YXS(6)
COMMON PS12LP,SARC(513),SARC(513),LP4,DE
COMMON BETAV(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XRDND,A2AA,B2BB,C2CC
COMMON AAAA,B3BB,CCC,A2,B3,C3,DE,TGAJS(100),TGAJS(100),NGAUS
SUBROUTINE F1INTL CALCULATES THE INTEGRALS IN F(1)
ISHARP = 7 FOR SHARP L.E.FOILS.
ISHARP = 1 FOR ROUNDED L.E.FOILS.
IF FOILS HAVE ROUNDED L.E., CHEBYSHEV-GAUSS
QUADRATURE
QUADRATURE FORMULA CAN NOT BE USED. SINCE BETA
IS NOT A SMOOTH FUNCTION.
NCHBY = NUMBER OF CHEBYSHEV-GAUSS QUADRATURE CONTROL POINTS.
PAI = 3.141592654
IF (ICPI.EQ.0) GO TO 3
DO 70 I3 = 1,6
70 XST(I3) = XSN(I3)
DO 12
9 DO 11 I1 = 1,5
11 XST(I1) = YXS(IH)
12 CONTINUE
5 DV1 = (XST(1)+1.)*.5
DV2 = (XST(1)-1.)*.5
A11 = (DN2-XST(2))/DV1
A12 = (DN2-XST(3))/DV1
B25 = (XST(1)+XST(2))*.5
CM25=(XST(2)-XST(1))*.5
A31 = (B25+1.)/CM25
A32 = (-B25+XST(3))/CM25
FCAS = (XST(3)-XST(2))*.5
FC15 = (XST(3)+XST(2))*.5
A41 = (FC15+1.)/FCAS
A42 = (FC15-XST(1))/FCAS
SPACE2 = (XST(3)-XST(2))/LP4
READ LPMM FOR THE SECOND ARC.
IF (KCTRL.GE.2) GO TO 100
IF (IJ.GE.2) GO TO 100
CSPACE = (1.+XST(1))/F_DAT(LPK)
SPACE = CSPACE/F_DAT(LPM-LPK)
IDM = 1
XCHCK = -1.
SPACE=CSPACE
DO 20 ICHBY=1,NCHBY
VCH=NCHBY-ICHBY+1
AJ(IC4BY)=COS((2*VCH-1)*PAI/(2*VCHBY))
XSI=DV1*AJ(IC4BY)+DV2
IF (ITERA.EQ.1) DO 433
22 IF (XCHCK.GE.XSI) DO 21
IF (IDM.GE.LPK) SPACE = ESPACE
XCHCK = XCHCK+SPACE
IDM = IDM+1

```

```

      GO TO 22
C  <<SI EXISTS BT. XSI(IOM-1) AND XSI(IOM)
21 CONTINUE
  IOMA = IOM-1
  BETAN(ICHBY) = BETAN(IOM)+(BETAN(IOM)-BETAN(IOMA))
  *(XKSI-XCHCK)/SPACE
C  BETAN IS USED FOR CHEBYSHEV-GAUSS INSTEAD OF BETAN.
  GO TO 20
433 BETAN(ICHBY) = SBETA
C  BETAN FOR ITERA.E2.1 IS SPECIFIED IN DFSIM1.
  20 CONTINUE
100 CONTINUE
  IF((KCTRL.E1.4) GO TO 4
  IF ((KCTRL.E1.3) GO TO 3
  IF ((KCTRL.E1.2) GO TO 2
  IF ((ISHARP.EG.1) GO TO 10
  YINT = 0.
  DO 110 ISJM = 1,NCHBY
  ABC = (AJ(ISJM)+A11)/(AJ(ISJM)+A12)
  110 YINT = YINT + BETAN(ISUM)*SGRT(ABC)
  YINT = YINT*PAI/NCBY
  GO TO 1000
10 CONTINUE
C  THIS IS THE CASE OF HANDLING RIVED L. E. .
  NCF = 0
  XCA = 0.
  CALL DFSIM1(YINT,NCF,XCA)
C  XCA IS DUMMY, ONLY USED FOR F(5) INDEXING.
  GO TO 1000
2 CONTINUE
  XCA=0.
C XCA IS DUMMY.
  ISIC=2
  CALL IC2(SR,SM,XCA,ISIC)
  YINT=SR
  GO TO 1000
3 CONTINUE
-----INTEGRAL FOR I3.
C  AJ(N) IS CALCULATED AND STORED
  YINT = 0.
  DO 120 ISJM = 1,NCHBY
  A31 = 1.-AJ(ISJM)
  A32 = (AJ(ISUM)+A31)*(A32-AJ(ISJM))
  SGAB2 = SGRT(A32)
  ABC = A31/SGAB2
  120 YINT = YINT+ABC
  YINT = YINT*PAI/NCHBY
  GO TO 1000
-----INTEGRAL FOR I4
C  SINCE BETAN(Y) BTWY TOT AND TFT ARE
C  EXPECTED TO BE ALWAYS SMOOTH, USE GAUSS-
C  CHEBYSHEV QUADRATURE FORMULA.
C  AJ(N) IS ALREADY CALCULATED.
C  IF THIS IS THE FIRST CASE FOR BETAN2,
C  USE A CONSTANT FOR BETAN2.
C  BETAN2 IS USED FOR CHEVY-GAUSS INSTEAD OF BETAN2.
4 CONTINUE
  IF(ITERA.E2) GO TO 150
  IF(IJ.E2) GO TO 131
C  SBETA2 MUST BE READ FOR THE FIRST RUN.

```

```

    DD 180 IC4BY = 1,NC4BY
130 BBTAU2 (IC4BY) = SBBTAU2
    VS21=VS2+1
    DD 185 IOC=1,NS21
135 BBTAU2(IOC)=SBBTAU2
    GJ TO 181
150 CONTINUE
    I=(IJ.GE.2) GJ TO 181
    IO4M = 1
    XCHECK = XST(2)
    DD 170 IC4BY = 1,NC4BY
    XSI = FCA5*AJ(IC4BY)+FC15
152 I=(XC4CK.GE.XSI) GJ TO 151
    XCHECK = XCHECK + SPACE2
    IO4M = IO4M+1
    GJ TO 152
151 CONTINUE
    IO4MA = IO4M-1
    BBTAU2(IC4BY) = BBTAU2(IO4M)
    1+(BBTAU2(IO4M)-BBTAU2(IO4MA))*(XSI-XCHECK)/SPACE2
    ILM=IC4BY
    XSI = FCA5*AJ(ILM)+FC15
    WRITE(6,250) ILM,BBTAU2(ILM),XSI
250 FORMAT(15X,*I=*,I3,2X,*BBTAU2=*,E14.7,2X,*XSI=*,E14.7)
170 CONTINUE
181 CONTINUE
    YINT = 0.
    DD 190 ISUM = 1,NC4BY
    AB1 = (BBTAU2(ISUM)*PAI)*(1.+AJ(ISU4))
    AB2 = (AJ(ISUM)+A41)*(AJ(ISUM)+A42)
    SAB2 = SRT(AB2)
183 YINT = YINT + AB1/SAB2
    YINT = YINT*PAI/NC4BY
1900 CONTINUE
    RETURN
    END

```

```

SUBROUTINE CAVITY (XCC,YCC)
C THIS SUBROUTINE IS CALLED FROM DXFVE. FOR F(5).
DIMENSION XEX(100),SKEY(100),ANSI1(100),SRI2(100),SIC3I3(100)
DIMENSION SIC4I4(100),XST(5)
DIMENSION CAVXX(100),CAVYY(100)
COMMON YCCC,SBETA2
COMMON XITV(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,-P44,NS2
COMMON AJ(100),ISHAR3,NCHBY,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON F_LAPAV,DELTA,IGAP,A_FA1,GA441
COMMON SIGMA,SBETA,((1,ICPI,SARC0)(513))
COMMON IDJL,XA,XB,XC,TANGEP,YC,YR,JBISS,XLBIS,BIGS,SMALS,DSS
COMMON XS(5),CCC1,CL,E,R,C,YYY,KM,ITERA,SXSIO(5),SXSI00(6),YYS(5)
COMMON PSIZ,LPM,SARC(513),SARC0(513),LPM,DE
COMMON BETAM(513),BETAM(513),IJ,LPM,XII(200),KJJ(200),XCX
COMMON XROJN,A2AA,B2BB,C2CC
COMMON AAA4,B3B3,C3C3,45,38,39,3E,FGAUS(100),FGAJS(100),NGAUS
C XCC IS THE CAVITY END POINT CALCULATED IN SUB. CAVITY.
SCGM = SQRT(1.+SIGMA)
CDEL = COS(CDELTA)
SDEL = SIN(CDELTA)
PAI = 3.141592654
DO 1 LDA = 1,5
1 XST(LDA) = YXS(LDA)
NCAV=30
NCAV1=NCAV+1
CAVS = (XST(2)-XST(1))/NCAV
C LEAVE THE LAST POINT OF XSI = C SINCE THERE IS A
C SINGULARITY FOR SINGLE SPIRAL VORTEX MODEL.
DO 2 KLM = 1,NCAV1
XCA = XST(1) +CAVS* ((KLM-1)
C REAL PART OF OMEGA = BETAB+ PAI.
IF (KLM.EQ.1) GO TO 3
IF ((IJ.EQ.1).AND.(NCAV1)) GO TO 10
C-----IC1(XSI) CALCULATION. CALLING OFSIM1.
IF (IJ.GE.34) GO TO 75
NDF = 3
CALL OFSIM1(ANS,NDF,(CA)
C ANS IS A SOLUTION FOR IC1(XSI). XSI IS IDENTICAL TO XCA.
IF (IJ.EQ.27) ANSI1(KLM) = ANS
GO TO 76
75 ANS = ANSI1(KLM)
76 CONTINUE
C-----IC2(XSI) CALCULATION.
IF (IJ.GE.34) GO TO 77
ISIC = 1
CALL IC2(SR,SM,XCA,ISIC)
C ONLY SR IS JINITIZED-- SM IS FOR RMINT.
IF (IJ.EQ.27) SRI2((1,-M) = SR
GO TO 78
77 SR = SRI2((1,-M)
78 CONTINUE
C-----IC3 ((SI) CALCULATION-- USE CIE3YS4EV-GAUSS
C QUADRATURE FORMULA.
BPC5 = (XST(1)+XST(2))*0.5
CMBS = (XST(2)-XST(1))*0.5
A31 = (BPC5+1.)/CMBS
A32 = (-BPC5+XST(3))/CMBS
E1 = XCA-XST(2)
E2 = (XCA+1.)*(XCA-(ST(1))+(XCA-(ST(3)))

```

```

EK3 = SQRT(EK1/EK2)
EF33 = CM35*E<3
IF (IJ>GE.34) GO TO 30
SIC3 = 0.
DO 5 ISUM = 1,NCM3Y
EJ1=(AJ(ISJM)+A31)*(A32-AJ(ISJM))
SEJ1 = SQR(EJ1)
E<3 = (1.-AJ(ISUM))/SEJ1
EF3A = CM35*AJ(ISJM)+FPC5-XCA
5 SIC3 = SIC3+(EF3-EF3B+SQRT(1.-AJ(ISJM)**2))/EF3A
SIC3 = SIC3*PAI/NCM3Y
SIC3 = SIC3*ALOG((XST(2)-XCA)/(XCA-KST(1)))*E<3
IF(IJ.EQ.27) SIC3I3(L_4) = SIC3
GO TO 31
30 SIC3 = SIC3I3(KLM)
31 CONTINUE
C-----IC4(XSI)----.
C JSE CHEBYSHEV-GAUSS QUADRATURE FORMULAE
C IN THE SAME MANNER AS THAT FOR IJ IN
C JFSI43.
IF(IJ>GE.34) GO TO 32
FPC5 = (XST(3)+XST(2))*+.5
F4C5 = (XST(3)-XST(2))*-.5
A41 = (FPC5+.1.)/FMC5
A42 = (FPC5-XST(1))/F4C5
SIC4 = 0.
DO 7 ISJM= 1,NCM3Y
RA = (BETAV2(ISJM)+PAI)*(1.+AJ(ISJM))
RB = (AJ(ISUM)+A41)*(AJ(ISJM)+A42)
SRB = SQR(RB)
RC = RA/SRB
RD = FMC5*AJ(ISJM)+FPC5-XCA
7 SIC4 = SIC4+RC/RD
SIC4 = SIC4*PAI/NCM3Y
IF(IJ>GE.27) SIC4I4(L_4)= SIC4
GO TO 33
32 SIC4 = SIC4I4(KLM)
33 CONTINUE
C IC(XSI) = 1/EK3 ALREADY CALCULATED.
LJ2 = C*SAI*PAI+GAMMA)/COS(KST(5)+GAMMA)/KST(5)
GC = (-AVS*PAI-SR*(CCS1-ALD3(JJ2)/PAI)*SIC3
1-SIC4*PAI)/EK3
GC TO 25
3 GC = BETAB*PAI
GO TO 25
10 GC=BEFAC*PAI
C BETAB AND BEFAC BODY ANGLES AT B AND C MUST BE SPECIFIED IN COMMON.
25 CONTINUE
XXS = XCA-CDE_
YYT = XCA-XST(4)*SDEL
YYT2 = YYT**2
XXU = XST(4)*COEL
KKU2 = XXJ**2
XYB = YYT2+XXU2
DWDX = DGA*XXS/(XYB*PAI)
CGC = COS(GC)
SGC = SIN(GC)
CFC = DDX/SCGM
CKEX(KLM) = CGC*CFC
SKEX(KLM) = SGC*CFC

```

```
2 CONTINUE
CAVXX(1)=3.
CAVYY(1)=0.
DO 15 ICAV=3,NCAV1+2
CAVXX(ICAV) = CAVXX(ICAV-2)+CAVS*(CEX(ICAV-2)+4.+*
CKEX(ICAV-1)+CKEX(ICAV))/3.
15 CAVYY(ICAV) = CAVYY(ICAV-2)
1+CAVS*(SKEY(ICAV-2)+4.+SKEY(ICAV-1)+SKEY(ICAV))/3.
IF(IJ.EQ.27) GO TO 100
GO TO 101
100 DO 102 ICAV=1+NCAV1+2
CAVX(ICAV)=CAVXX(ICAV)
102 CAVY(ICAV)=CAVYY(ICAV)
XCCC=CAVX(NCAV1)
YCCC=CAVY(NCAV1)
101 CONTINUE
XCC=CAVXX(NCAV1)
YCC=CAVYY(NCAV1)
RETURN
END
```

PCASOWI

```

SUBROUTINE G2 (XS2,A2,IS2)
DIMENSION XST(6),XI21S(200),XI22S(200),XI23S(200),XI24S(200)
COMMON YCCC,SBETA2
COMMON XIT4(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVK(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPM44,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAN(100),EBTAN2(100),BETAN2(100)
COMMON FLAPAN,DELTA,J3AP,A_FA1,GAMMA
COMMON SIGMA,SBETA,XXM,ICPI,SARC0(513)
COMMON IDJ_,XA,XB,XC,TANG,E_P,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(6),CCC1,_E,ERC,YYY,XM,ITERA,KSIC(6),SXSI(6),YXS(6)
COMMON FSIZ,LF,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPM,XII(200),JJ(200),XDX
COMMON XROUND,A2AA,32B5,C2C5
COMMON AAAA,53B3,CCC3,A8,E8,C8,D8,TGAJS(100),GAJ5(100),NGAUS
THIS SUBROUTINE IS CALLED BY DFSI45.
THIS SUBROUTINE CALLS FUNCTIONS FUNCTION G2(XS2) WHICH
INC-ODES I21(XS2) TO I24(XS2).
XS2 IS XS1-A2 IS THE SOLUTION OF INTEGRALS.
DO 1 IGP=1,6
1 XST(IGP)=YXS(IGP)
PAI = 3.141592654
IF (IJ.EQ.34) GO TO 100
-----I21(XS1)-----
THE SAME INTEGRATION AS THAT IN
SUBROUTINE CAVITY FOR GS(XS1)
V1F = 3
CALL DFSIM1(ANS,NCF,XS2)
XI21 = ANS
IF (IJ.EQ.27) XI21S(IS2) = XI21
-----I22(XS1)-----
USE THE SAME SUBROUTINE IC2 AS
USED IN CAVITY WITH ISIC=1.
ISIC=1
CALL IC2(SR,SM,XS2,ISIC)
XI22 = SR
NOTE THAT SM IS DUMMY VARIABLE.
IF (IJ.EQ.27) XI22S(IS2) = XI22
-----I23(XS1)-----
USE CHEBYSHEV-GAUSS QUADRATURE FORMULA
IN EXACT-Y SI41-LAR MANNER TO THAT IN
GFSI*3 FOR I3.
XI23 = 0.
SPC5 = (XST(1)+XST(2))/4.5
CM35 = (XST(2)-XST(1))/4.5
A31 = (SPC5 + 1.)/CM35
A32 = (-SPC5 + XST(3))/CM35
DO 2 ISUM = 1,V24BY
HA1 = 1.-AJ(ISUM)
HA2 = (AJ(ISUM) + A31)*(A32-AJ(ISUM))
SHA2 = SQRT(HA2)
F3I3 = HA1/SHA2
F3AI3 = CM35*AJ(ISUM)+SPC5-S2
2 XI23 = XI23+F3I3/F3AI3
XI23 = XI23*PAI/V24BY
IF (IJ.EQ.27) XI23S(IS2) = XI23
-----I24-----
USE CHEBYSHEV-GAUSS QUADRATURE
FORMLA BY ASSUMING THAT
THE KERNEL FCV. IS SMOOTH.
HU = (XS2+1.)*(XS2-XST(1))*(XST(3)-S2)

```

```

1/ = S2-XST(2)
Hd = SQRT(HU/HV)
FPC5 = (XST(3)+XST(2))*5
F4C5 = (XST(3)-XST(2))*5
A41 = (FPC5+1.)/FMC5
A42 = (FPC5-XST(1))/F4C5
XI24 = 0.
JJ 10 ISJ4 = 1, NC43Y
TPA1 = AJ(ISUM)+A41
TPA2 = AJ(ISUM)+A42
STP = SQRT(TPA1*TPA2)
F4T = (BETAV2(ISUM)+PAI)*(1.+AJ(ISJ4))/STP
: BETAN2 IS CHEBY-GAUSS VERSION FOR BETA ON THE SECOND ARC.
F_A = FMC5*AJ(ISUM)+FPC5-XS2
SI2 = SQRT(1.-AJ(ISJ4)**2)
F4B = FMC5 *ST2*(BETAV2(IS2 )+PAI)/HV
10 XI24 = YI24*(F4T-F4B)/F4A
XI241 = XI24*PAI/NC43Y
: BETAV2 IS USED FOR SINCSINVS RUE.
4L3 = A_0G((XST(3)-(S2)/(S2-XST(2)))
: IS2 IS TRANSFERRED THROUGH S2-ARGUMENT.
XI242 = X_L3*(BETAV2(L32)+PAI)/14
XI24 = XI241+XI242
I=(IJ.EQ.27) XI245(L32) = XI24
30 TO 101
106 XI21 = XI21S(L32)
XI22 = XI22S(L32)
XI23 = XI23S(L32)
XI24 = XI24S(L32)
101 XS2A = -XI21/PAI-XI22
XS23 = CCC1-ALOG(COS(A_FA1+SA44A)/COS(XST(5)+SA44A) /XST(6))/PAI
: IAF/))AMMAG+1AF_A(SOC(GOLA-1CCC = 32SK
XS20 = XS23*XI23
XS21 = -XI24/PAI
AS2 = (XS2A+XS2C+XS2D)*4J
: 2SI+42IX+32IX+22IX+12IX )25,6(ETIRw )2,2E.25I.DVA.72.GE.JI( FI
: 2SI+42IX+32IX+22IX+12IX )25,6(ETIRw )01.QE.25I.DNA.72.GE.JI( FI
: 2SI+42IX+32IX+22IX+12IX )25,6(ETIRw )03.2E.2SI.DVA.72.GE.JI( FI
: +X2,)X2,7.+1E(4,*--ERA )5(F FO 4I,3I+2I+1I---*,XC1(TAMRCF 25
: )4I,*=25I+ A
: RETJRV
END

```

```

SUBROUTINE R4INT (SR,SM,M1Q)
DIMENSION XST(6)
COMMON YCCC,SBETA2
COMMON XIT4(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAP,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),ISHAR2,VCHBY,BBTAN(100),BBTAV2(100),BETAV2(100)
COMMON FLAPAV,DELTA,JGAP,ALFA1,GAMMA1
COMMON SIGMA,SBETA,XXI,ICPI,SARC00(513)
COMMON IDJ_,XA,XB,XC,TANG,E2,YC,YR,JBIGS,XLBISS,BIGS,SMALS,CSS
COMMON XSN(6),CCC1CL2,ERC,YYY,XM,ITERA,SXSIO(6),SXSI0(6),YXS(6)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPW,DE
COMMON BETAN(513),BETAV(513),IJ,LPK,XII(200),XJJ(200),XGX
COMMON XH3JND,A2AA,3233,C2CC
COMMON AABA,BBEE,CCCD,A5,B3,C6,CS,TSaus(100),NGaus(100),NGaus
PAI = 3.141592654
IF (ICPI.EQ.0) GO TO 10
DO 12 I5 = 1,6
12 XST(I5) = XSN(I5)
GO TO 11
13 DO 1 IS = 1,6
1 XST(IS) = YXS(IS)
11 CONTINUE
XX1 = XST(4)*SIN(DE-TA)
YY1 = XST(4)*COS(DE-TA)
YY12 = YY1**2
CB5 = (XST(2)-XST(1))**5
BC5 = (XST(1)**XST(2))**5
A31 = (BC5+1.)/CB5
A32 = (-BC5*XST(3))/CB5
B415 = (XST(1)**1.)*5
B215 = (XST(1)+1.)*5
A11 = (BM15-XST(2))/B215
A12 = (BM15-XST(3))/B215
FPC5 = (XST(3)+XST(2))*5
FMCS = (XST(3)-XST(2))*5
A41 = (FPC5+1.)/FMCS
A42 = (FPC5-XST(1))/FMCS
IF (M1Q.EQ.4) GO TO 4
IF (M1Q.EQ.3) GO TO 3
IF (M1Q.EQ.2) GO TO 2
: AJ(I) ARE ALREADY CALCULATED IN SUBROUTINE
: T=INT_1 AND STORED IN COMMON AREA.
SR=0.
SM=1.
DO 20 ISUM = 1,NC1BY
GX1 = 1.-AJ(ISJ4)
GY1 = (AJ(ISUM)+A31)*(A32-AJ(ISJ4))
SGY1 = SQRT(GY1)
FF3 = GX1/SGY1
FX1 = CB5*AJ(ISJ4)+BC5
FX2 = FX1-KX1
FX22=FX2**2
FX3 = FX22+YY12
FF31 = FX2/FX3
FF32 = YY1/FF31
SR = SR+FF3*FF31
20 SM = SM+FF3*FF32
SI = SR*PAI/VCHBY
SM = SM*PAI/VCHBY
GO TO 1000

```

```

2 CONTINUE
IF (IS1AR3.EQ.1) GO TO 100
IS1AR3 = 1 MEANS THAT THE FDI_ HAS ROUNDED L.E.
SO THAT THE SIMPSONS RULE IS USED.
IS1AR3 = 0 MEANS THAT THE FDI_ HAS SHARP L.E.
SO THAT CHEBYSHEV GAUSS FORMULA CAN BE USED AS BELOW.
SR = 0
SM = 0
DO 30 ISUM = 1,NCHBY
ST11 = AJ(ISJ4)+A11
ST12 = AJ(ISUM)+A12
F<1 = BBTA4V(ISUM)+SQRT(ST11/ST12)
UN1 = BP15*AJ(ISUM)+BM15-XX1
JV12 = JV1**2
UN13 = JV12*YY12
F<11 = UN1/JN13
F<12 = YY1/JN13
SR = SR+F<1+F<12
30 SM = SM+PAI/NCHBY
SR = SR+PAI/NCHBY
SM = SM+PAI/NCHBY
GO TO 1000
100 CONTINUE
C THIS IS THE CASE THAT THE FDI_ HAS ROUNDED L.E.
NOF = 1
XCA = 0.
CALL DFSIM1(SR,NOF,XCA)
C XCA IS DUMMY----ONLY USED FOR F(5) IN DFNEW.
NOF=2
CALL DFSIM1(SM,NOF,XCA)
GO TO 1000
3 CONTINUE
JSE CHEBYSHEV-GAUSS FORMULA SINCE BETA
IN THIS REGION IS SMOOTH.
BBTA4V2 (ISJ4) ARE ALREADY CALCULATED AT PINT-T.
SR = 0.
SM = 0.
DO 50 ISJ4 = 1,NCHBY
PSL = (BBTA4V2(ISUM)+PAI)*(1.+AJ(ISJ4))
PSM = (AJ(ISJ4)+A41)*(AJ(ISJ4)+A42)
SQPSM = SQRT(PSM)
FF4 = PSL/SQPSM
PSV = FPC5*AJ(ISUM)+FPC5-XX1
PSV2 = PSV**2
FF41 = PSV/(PSV2+YY12)
FF42 = YY1/(PSV2+YY12)
SR = SR+FF4+FF41
SM = SM+FF4+FF42
50 CONTINUE
SR = SR+PAI/NCHBY
SM = SM+PAI/NCHBY
GO TO 1000
4 CONTINUE
XCA IS DUMMY, ONLY USED FOR IC2 IN F(5)
XCA = 0.
ISIC = 0
SUBROUTINE IC2 IS ALSO USED IN F(5).
CALL IC2(SR,SM,XCA,ISIC)
1000 RETJRV
END

```

```

SJROUTINE SHAPE(X,Y,BETA,IS1I2)
COMMON/FREECAV/XFREEC,YFREEC
COMMON/JPPER/A2AAU,B235U,C2CCU,AAAAJ,BBBBU,CCCCJ,AEU,BBJ,C8U,D8U
COMMON/THICK/TH
COMMON/YCOC,SBETA2
COMMON/XIT4(200),XITN(200),ANSG2S(200),SARC2(200)
COMMON/CAV/(100),CAVY(100),BETAB,SETAC,XCCC,NCAV,LP14,NS2
COMMON/AJ(100),ISHARP,NCHBY,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON/ELAPAN,DELTA,DGAP,ALFA1,SA4MA
COMMON/SIGMA,SBETA,XXM,ICPI,SARCO(513)
COMMON/IDJL,XA,XB,XC,TANG,EP,YC,JBIGS,XLBIGS,BIGS+SMALS,DSS
COMMON/XSV(6),CCC1,C_E=ERC,YYY,XM,ITERA,SKSID(6),SXSID(6),YXS(6)
COMMON/PSIZ,LP,SARC(513),LPM,DE
COMMON/BETAN(513),BETAN(513),IJ,LPC,XII(200),XJJ(200),XDX
COMMON/XRQJND,A2AA,B233,C2CC
COMMON/AAA,B333,CCC,A8+B9,C9,D8,TGAJS(100),NGAUS
PAI =3.141592653
X2=X**2
X3=X**3
XS=SQRT(X)
X1=X**4
XFREE2=XFREEC**2
XFREE3=XFREEC**3
XFREEE=SQRT(XFREEC)
XFREE4=XFREEC*XFREEE
X22=.2**2
X23=.2**3
X2S=SQRT(.2)
X2H=.2*X2S
X32=.3**2
X33=.8**3
X9S=SQRT(.8)
X34=X3S*.3

```

C DE JUST CHECK TO SEE IF WE ARE GOING TO CALCULATE THE TOP PART
C OR THE BOTTOM PART. IF TOP WE TRANSFER TO 2ND HALF OF ROUTINE.
C IS1I2 = 3 IS USED FOR CALCULATIONS OF UPPER FOIL PROFILE

```

17 I=(IS1I2.EG.1) GO TO 30
I=(IS1I2.EG.3) GO TO 30

I=(X_E..2) GO TO 15
I=(X.LE..9) GO TO 20
I=(X.GT..9) GO TO 25

15 Y=A2AA*X+B235*X2+C2CC*X3
YJX=A2AA+B235*2.*X+C2CC*3.*X2
BETA=ATAN(YJX)
GO TO 60

20 Y=AAA*(4./3.*X+8./3.*XH-4.*X2)+B333*X+CCCC*X5
YJX=AAA*(4./3.*X+8./3.*X+5.*XS-9.*X)+B333+5.*CCC/C*XS
BETA=ATAN(YJX)
GO TO 60

25 Y=A3+B3*X+C5*X2+D5*X3
YJX=B3*2.*C5*X+3.*D5*X2
BETA=ATAN(YJX)
GO TO 60

```

C THIS 2ND HALF OF THE ROUTINE IS FOR CALCULATING THE UPPER HALF

```

30 IF (IS1I2.EQ.3) GO TO 70
IF (X=FREEC+LE..2) GO TO 35
IF (X=FREEC-E..2) GO TO 50
IF (XFREEC>T..8) GO TO 55
70 CONTINUE
IF (X.LE..2) GO TO 35
IF (X.LE..3) GO TO 50
IF (X.GT..3) GO TO 55

35 R1=YFREEC-A2AAJ*XFREEC-92B9J*XFREEC-C2CCU*XFREE3
IF (IS1I2.EQ.3) R1=0.
IF (X.GT..2) GO TO 40
Y=A2AAU*X+32BBU*X2+C2CCU*x3+R1
YDX=A2AAU*2.*32BBJ*(+3.*C2CCJ*x2
BETA=ATAN(YDX)-PAI
GO TO 60
40 Y2=A2AAJ*+2*B2B9J*x22+C2CCJ*x23+R1
R2=Y2-AAAAJ*(4./3.*2+B./3.*X2+-4.*X22)-B5B8U*.2-CCCCU*x2S
IF (IS1I2.EQ.3) R2=0.
IF (X.GT..3) GO TO 45
Y=AAAAAJ*(4./3.*X+8./3.*X4-4.*X2)+353BJ*x+CCCCJ*xS+R2
YDX=AAAAAJ*(4./3.*5./3.*1.5*(S-5.*X)+353BJ+.5*CCCCJ/xS
BETA=ATAN(YDX)-PAI
GO TO 60
45 Y3=ABJ+B8U*.8+C8U*x32+D6U*x33+R2
R3=Y3-48U-B8U*.8-C8J*x82-D8J*x93
IF (IS1I2.EQ.3) R3=0.
46 Y=ABU+B8J*x+C8J*x2+D8J*x3+R3
YDX=B8J*2+C8J*x+3.*D8J*x2
BETA=ATAN(YDX)-PAI
GO TO 60
50 R2=YFREEC-AAAAU*(4./3.*XFREEC+8./3.*XFREEH-4.*YFREE3)-B3EBU*XFREEC
1 -CCCCJ*XFREE3
IF (IS1I2.EQ.3) R2=0.
IF (X.GT..3) GO TO 45
Y=AAAAAJ*(4./3.*X+5./3.*X4-4.*X2)+353BJ*x+CCCCJ*xS+R2
YDX=AAAAAU*(4./3.*B./3.*1.5*xS-8.*X)+B3EBU*.5*CCCCU/xS
BETA=ATAN(YDX)-PAI
GO TO 60
55 R3=YFREEC-ABJ*XFREEC-C8J*XFREE2-D8J*XFREE3
IF (IS1I2.EQ.3) R3=0.
GO TO 46

50 RETURN
END

```

```

SUBROUTINE ARCS2(S2,(C,YC)
COMMON/FULLEN/XDD0,YYDD
CMM404/JP2ER/A24AJ,3233J,C2CCJ,AAAAJ,BB8EJ,CCDCJ,A8J,B8J,C8J,D8J
C XDD IS THE ENDPOINT OF THE JPER FOIL OFFSET
IF (XC.LE.0.) GO TO 10
GO TO 11
10 WRITE(5,12)
12 FORMAT(10X,----- STOP FOR XC LESS THAN ZERO, DONE AT ARCS2 -----)
STOP
11 CONTINUE
CXDD=XXDD
XHIGH=0.
X_J=0.
XINCRT=(C(XDD)-XC)/50.
IF (XINCRT.EQ.0.) XINCRT=-XINCRT
IS112=1
S2=C.
DO 24 IINC=1,50
X_J=XHIGH
XHIGH=XLOW+XINCRT
CALL ARCLEV(S,X_J,XHIGH,IS112)
24 S2=S2+S
RETURN
END

```

**

```

SJBRDT1NE XCYC(XC3,YC3,CX,CY)
COMM0V/UPPER/A2AAJ,3255U,C2CCJ,AAAAAJ,BESEJ,CCCCJ,A8J,88U,CEU,D6U
X<=CX
X<2=X<+2
X<3=X<+3
X<S=SART(X<)
X<H=X<+XKS
IP=9
IF (CX.LE..2) GO TO 3
IF (CX.LE..3) GO TO 4
IF (CX.GT..3) GO TO 5
3 F1=A2AAJ*X<+B255U*X<2+C2CCJ*X<3
F2=A2AAJ+2*B255J*X<+3+C2CCJ*X<2
F3=XK-CY
FXK=F1+(F3/F2-CY)
D1=F2
D2=(D1+F3*(2+B255J*3+C2CCJ*X<))/D1**2
J=I1+02
DIV=FXK/DFXK
X<=X<-DIV
IP=IP+1
Z=ABS(DIV/X<)
I=((Z*LE..0J0001).OR.(IP.EQ.20)) GO TO 6
30 TO 3
4 F1=AAAUAU*(4./3.*X<+3./3.*X<+4.*X<2)+B355J*X<+CCCCJ*X<3
F2=AAA AJ*(4./3.*8./3.*1.5*X(S-5.*XK)+B355J+CCCCJ*.5/XKS
F3=X<-CX
FXK=F1+(F3/F2-CY)
D1=F2
D2=(D1-F3*(AAA AJ*(8./3.*1.5*.5/X(S-3.))-CCCCJ*.5*.5/XKH))/D1**2
J=I1+02
DIV=FXK/DFXK
IP=IP+1
Z=ABS(DIV/X<)
I=((Z*LE..J33001).OR.(IP.EQ.20)) GO TO 6
30 TO 4
5 F1=A8J+B8J*X<+C8J*X<2+D8U*X<3
F2=B3J+2*C8U*X<+3*D8J*X<2
F3=X<-CX
FXK=F1+(F3/F2-CY)
D1=F2
D2=(D1-F3*(2+C8U*5.+D8U*XK))/D1**2
J=I1+02
DIV=FXK/DFXK
X<=X<-DIV
IP=IP+1
Z=ABS(DIV/X<)
I=((Z*LE..J33001).OR.(IP.EQ.20)) GO TO 6
30 TO 5
6 XCB=X<
IF (CX.LE..2) YCB=A244J+X<+B255J*X<2+C2CCJ*X<3
IF (CX.LE..3) YCB=AAA AJ*(4./3.*X<+8./3.*X<+4.*X<2)+B355J*XK
IF (CX.GT..8) YCB=A8J+B8J*X<+C8J*X<2+D8U*X<3
RETURN
END

```

```

SUBROUTINE FC2(T,F,XH,ISII2)
COMMON/UPEP/A2AAU,323BU,C2CCJ,44AAJ,399BU,CCCCJ,AEJ,BBU+C8U,D8U
COMMON YCCC,S3ET42
COMMON KITM(200),KITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAV+LPMM,VS2
COMMON A4(100),IS4R3,VCH3Y,BTAN(100),BTAN2(100),BTAV2(100)
COMMON FLAPAN,DELTA,D34P,ALFA1,GAMMA
COMMON SIGMA,SSETA,X4,ICPI,SARCO(513)
COMMON ICUL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS+SMALS+DSS
COMMON XS(5)*CCC1,C_E,ERC,YYY,XM+ITERA,SXSID(5),SXSID(6),YXS(5)
COMMON PSIZ,L_P,SARC(513),SARC(513),Z_P,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XRIJND,A2A4,3233,C2CC
COMMON AAAA,BBBB,CCCC,A6,B8,C8,D6,TGAJS(100),GAUS(100),NGAUS
LICNT=1
XP=(YH-XL)*T+.5+(XH+XL)*.5
SX=P=SQRT(XP)
XP2=XP**2
IF(XP.GE..3) GO TO 1
IF(XP-.3.E-2.AND.IICNT.EG.1) GO TO 4
IF(XP.LE..2) GO TO 3
P1=(4./3.+4.*SX**2-4.*XP)*AAAA
P2=.533
P3=.5*CCCC/SX
IF(ISII2.EG.1) P1=(4./3.+4.*SX**2-4.*XP)*AAAAJ
IF(ISII2.EG.1) P2=.533BJ
IF(ISII2.EG.1) P3=.5*CCCCJ/SX
GO TO 2
3 P1=-.5*SQRT(2.*XRIJND)/SX**424A
P2=.533*SX**1.5
P3=2.*C2CC*XP
IF(ISII2.EG.1) P1=-.5*SQRT(2.*XRIJND)/SX**424AJ
IF(ISII2.EG.1) P2=.533J*SX**1.5
IF(ISII2.EG.1) P3=2.*C2CCJ*XP
GO TO 2
4 IJNTIVJE
P1=424A
P2=2.*.533*XP
P3=3.*C2CC*(XP
IF(ISII2.EG.1) P1=424AJ
IF(ISII2.EG.1) P2=2.*.533J*XP
IF(ISII2.EG.1) P3=3.*C2CCJ*XP2
GO TO 2
: P1=.5
P2=2.*.533*XP
P3=3.*.533*XP
IF(ISII2.EG.1) P1=.533J
IF(ISII2.EG.1) P2=2.*C5J*XP
IF(ISII2.EG.1) P3=3.*C5U*XP2
2 P4=P1*P2*P3
P42=P4**2
P5=1.*P42
S5=SQRT(P5)
F=(XH-XL)*S5*.5
RETJRV
END

```

```

SUBROUTINE MOSEC(A,B,ER1,ER2,X,J,XLP,A,IS1I2)
J=0
X1=A
X2=B
4 J=J+1
I=(J*3E+800) GO TO 9
CALL FARC(PFX1,XLP,A,X1,IS1I2)
CALL FARC(PFX2,XLP,A,X2,IS1I2)
X3=X1+(X2-X1)*PFX1/(PFX1-PFX2)
CALL FARC(PFX3,XLP,A,X3,IS1I2)
I=(PFX3)1,2+3
I 42=X3
X1=X3
I=(A-B)10+11+11
10 Y=X3-ER1
I=(Y-E+0.) Y=0.
GO TO 12
11 Y=X3+ER1
12 CALL FARC(PFY,Y,XLP,A,IS1I2)
I=(PFY) 5,2+2
3 X1=X3
X2=X2
I=(A-B) 20+20+21
20 Z=X3+ER1
GO TO 22
21 Z=X3-ER1
22 CALL FARC(PFZ,XLP,A,Z,IS1I2)
I=(PFZ)2+2+5
5 GO TO 4
2 P9=ABS(PFX3)
I=(PP-ER2) 3+5+4
6 X=X3
GO TO 7
8 WRITE(6,9) J
9 FORMAT(1X,24J=,I3)
STOP
7 RETURN
END

FUNCTION AIT<EV(X1,XX,YY,ZZ,N)
DIMENSION XX(1),YY(1),ZZ(21)
I=(N)1,1+2
1 AIT<EN=YY(1)
RETURN
2 IF (N>3T+20) N=20
N=N+1
DO 3 I=1,4
3 ZZ(I)=YY(I)
DO 4 I=1,N
DO 4 J=I,N
4 ZZ(J+1)=ZZ(I)+(X-XX(I))*(ZZ(J+1)-ZZ(I))/(XX(J+1)-XX(I))
AIT<EN=ZZ(N+1)
RETURN
END

```

**

```

SUBROUTINE DETERM (A,N,D)
C     DETERM REVISED 02-26-73
      REAL M
      DIMENSION A(50,50),SAVEA(50,50)
      IF (N .EQ. 1) GO TO 49
      C = 1.
      NN = N
      DO 9 J = 1,NN
      DO 9 I = 1,NN
9       SAVEA(I,J) = A(I,J)
      K = 1
      GO TO 13
12      K = K + 1
13      I = K + I
      L = K
      GO TO 17
15      I = I + 1
17      IF (.485*SAVEA(I,K)) .GT. ABS(SAVEA(L,K))) L = I
      IF (I .NE. NN) GO TO 16
      IF (L .EQ. K) GO TO 29
      J = K
      :    READ INTERCHANGE
      GO TO 23
23      J = J + 1
      SAVEKJ = SAVEAK(J,J)
      SAVEA(K,J) = SAVEA(-,J)
      SAVEA(L,J) = SAVEKJ
      IF (J .NE. NN) GO TO 22
      C = -C
22      I = K + 1
      GO TO 31
30      I = I + 1
31      CONTINUE
      IF (SAVEA(K,K) .EQ. 0.) GO TO 49
      4 = SAVEA(I,K) / SAVEA(K,K)
      SAVEA(I,K) = 0.
      J = K + 1
      GO TO 36
36      J = J + 1
      SAVEA(I,J) = SAVEA(I,J) - 4 * SAVEA(K,J)
      IF (J .NE. NN) GO TO 35
      IF (I .NE. NN) GO TO 30
      IF (K .NE. (NN-1)) GO TO 12
      D = 1.
      DO 43 I = 1,NN
      J = I
      J = J + SAVEA(I,J)
      IF (ABS(D) .LT. 1.E-36) GO TO 48
43      CONTINUE
      J = J * C
      RETURN
46      D = A(1,1)
      RETURN
48      D = 0.
      WRITE (6,51)
      RETURN
51      FORMAT(//$X,TERROR MESSAGE FROM DETERM./)
      1 $X,TMATRIX IS SINGULAR. DETERMINANT SET = 0.0 //)
      END

```

02-20-73

```

SUBROUTINE BBETA(X,XBETAI,IS1I2)
C THIS GIVES BETAI(X(XSI)).
COMMON YCCC,SBETA2
COMMON XITM(200),XITV(200),ANSG2S(210),SARC2(200)
COMMON CAVX(100),CAJY(100),BETAB,BETAC,XCCC,NCAV,LPM,NS2
COMMON AJ(100),ISHAR,P,NCBY,BBTAN(100),BETAN2(100),BETAV2(100)
COMMON FLAPAN,DELTA,DGAP,ALFA1,GAMMA
COMMON SIG44,SBETA4,CC4,LCP4,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(5),CCC1,LL,ERC,YYY,K4,ITER4,SXSIC(5),SXSIQB(5),YXS(5)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAV(513),BETAB(513),IJ,-P,XII(200),XJJ(200),XDX
COMMON XRQJNG,A244,B233,C222
COMMON AAAA,BBBB,CCCC,A8,B8,C8,D8,T3AJS(100),T3AJS(100),NGAUS
ER1=5.E-3
ER2=5.E-3
I=(IS1I2-EG+1) GO TO 20
C IS1I2=0 FOR S1.
C   1 FOR S2.
C     S1A=LPM-1
S1A=SARC(LP)
I=(L_P-EG+1) GO TO 11
DSS=SARC(LP)-SARC(L_P+1)
X_PA=XX
GO TO 21
20 S1A=SARC2(L_P)
I=(L_P-EG+1) GO TO 11
X_PA=XX
DSS=SARC2(L_P)-SARC2(L_P+1)
21 CONTINUE
XIA=X_PA
XIB=XIA+.001
CALL FARCFAR,X_PA,XIB,IS1I2)
IF(FAR.LT.0.) GO TO 3
XIA=XIB
GO TO 4
3 CALL MOSEC(XIA,XIB,ER1,ER2,XX,JII,X_PA,IS1I2)
GO TO 11
10 XX=0.
GO TO 11
113 XX=XCCC
11 CALL SHAPE(XX,Y,RBETA,IS1I2)
RETJRV
END

```

```

SUBROUTINE FARC(FAR,X_PA,X1B,IS1I2)
COMMON YCCC,S3ETA2
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NDAJ,+P44,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAN(100),BBTAV2(100),BETAN2(100)
COMMON FLAPAN,DELT4,33AP,ALFA1,GA1M1
COMMON SIGMA,S2ETA,KK4,ICPI,SARC00(513)
COMMON IDJL,XA,XB,XC,TANG,E2,YC,YR,JSIGS,X_BIGS,BIGS,SMALS,CSS
COMMON XS4(5),CCC1,C_E,ERC,YY,M,ITERA,SXSIO(5),SXSI0(6),YXS(6)
COMMON PSIZ,L_P,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XROUND,A2AA,32BB,C2CC
COMMON AAAA,B359,CCCC,A8,BB,C9,D8,TGAUS(100),GAUS(100),NGAUS
IF(XLPA.EQ.X1B) GO TO 1
CALL ARCLEN(XSS,X_PA,X1B,IS1I2)
GO TO 2
1 XSS=0.
2 CONTINUE
FAR=DSS-XSS
RETJRV
END

```

6.0 LISTING OF PCASLE

```

PROGRAM PCASLE(INPUT,JOJPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7,TAPE1)

C NONLINEAR PARTIALLY CAVITATING CASCADE CALCULATIONS.
C 5/17/1978 PROGRAMMED BY J. FURJTA.
C-----PROGRAM REVISED FOR FIXED CAVITY LENGTH VERSION ON 9/15/78.
COPEN JAKE MODEL (9/15/1979)

DIMENSION YBE(7),X2(7),BETAN0(513),BETAM0(513),BETA02(100)
DIMENSION SXSI(7),XXX(513),CP(513)
DIMENSION F_(200),F_(200),C2(101),XXX2(201),F_2(100),F2(100)
COMMON/FOILEND/XX00,YY00
COMMON/JPPER/A2AAJ,3233U,C2CCJ,AAAAJ,BBBBJ,CCCCJ,A8J,B8J,C8U,D8U
COMMON/CVTL/CAVLEV,BIGS2
COMMON/FRECAV/XFREEC,YFREEC
COMMON/DELTAD/DELT(7,7)
COMMON/THICK/IM
COMMON/YCCC,S3ETA2
COMMON/XIT*(200),XIT*(200),4NSG2S(200),SARC2(200)
COMMON/CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,_P44,NS2
COMMON/AJ(100),ISHAP^,CHBY,3BTAN(100),BBTAV2(100),BETAV2(100)
COMMON/FLAP4,DELTA,J3AP,A_FA1,GA444
COMMON/S3ETA,(K1,IC^1,SARC0(513))
COMMON/IDUL,XA,X5,XC,TANG,E,YC,YR,JBIGS,XLB1SS,BIGS,SMALS,DSS
COMMON/XSN(7),CL,ERC,YYY,KM,ITERA,SXSI0(7),SXSI00(7),YXS(7)
COMMON/PSIZ,LPM,SARC(513),SARC0(513),LPM,DE
COMMON/BETAN(513),BETAM(513),IJ,L^K,XII(200),KJJ(200),XJX
COMMON/XR0JN0,A2AA,3233,C2CC
COMMON/AAAA,BBBB,CCCC,A5,B8,C8,D8,TGAUS(100),NGAUS(100),NGAUS
C BETAN---FOR ARC 1 FOR REGULAR INTEGRAL.
C BBTAV IS FOR INTERPOLATED VERSION OF BETAN .
C BETAV2 FOR EQUALLY SPACED INCREMENT FOR ARC 2.
C BBTAN2 FOR CHEBYSHEV- GAJSS VERSION OF BETAN2.
PAI=3.141592653
REAL(5,793) VGAJS
VGAJS1=VGAJS+1
VVV2=VGAJS/2
VGAJS2=VVV2+1
READ(5,560) (TGAJS(I),I=NGAJS2,VGAJS)
READ(5,560) (WGAUS(I),I=NGAJS2,VGAUS)
DO 26 IG=1,VVV2
TGAJS(I)=TGAJS(VGAJS1-IG)
26 VGAJS(I)=VGAJS(NGAJS1-IG)
WRITE(5,551) (TGAJS(I),I=VGAJS2,VGAJS)
WRITE(5,552) (WGAUS(I),I=NGAUS2,NGAJS)
550 FORMAT(4F20.10)
551 FORMAT(1X,*T(I)=*,10(F10.8,1X))
READ(5,590) XX4

      DO 589 IDELT=1,7
589 READ(5,590) (DELT(I)DELT,A,I=1,7)
592 FORMAT(1X,*d(I)=*,10(F10.8,1X))

      READ(5,560) TH
      READ(5,560) R,AAAA,333B,CCCC
      READ(5,560) A5,B8,C8,D8

```

DDYY,DDXX,HT 9065,50AER

```

READ(5,560) XRDJND,A2AA,B233,C2CC
READ(5,560) AAAAU,B338J,CCCCU
READ(5,550) ABJ,B8J,C8J,D8J
READ(5,550) A2AAU,B233U,C2CCJ
READ(5,795) MC4BY
READ(5,1321) SBETA ,SBETAT2,SF4,BETAB,BETAC
READ(5,551) LPMS,LPKS,LPM2,IFLAG,IREAD,ISHARP
READ(5,201) NITER,MSEDP,MAXIT,VVK
READ(5,202) ALFA1S,GA44AS,SOLIS, CAVLEN
READ(5,223) DE,JG,DF
I CAVLEN IS A CAVITY LENGTH SPECIFIED.
DO 592 IDELTAI=1,7
592 WRITE(5,591) (DE_T(IDEFTA,I),I=1,7)

      WRITE(6,6553)
5553 FORMAT(1H1)
      READ(5,6555) ESPACE
5555 FORMAT(F13.5)
      WRITE(5,6557) ESPACE
5557 FORMAT(1X,///,1X,*ESPACE=*,F5.2,///)
      WRITE(6,5590) TH,XK
      WRITE(5,5551) BETAB,BETAC
      WRITE(5,555) R,AAAAA,B338*CCCC
      WRITE(5,555) AB,B8,C8,D8
      WRITE(6,557) XRDJND,A2AA,B233,C2CC
      WRITE(5,523) AAAAU,B338J,CCCCJ
      WRITE(6,524) ABU,B8J,C8J,D8J
      WRITE(6,525) A2AAU,B233J,C2CCJ
      WRITE(6,1229) LPMS,LPS,SBETA,IREAD,NCHENY
      WRITE(5,1321) DE,JG,DF,SF4
      WRITE(5,1521) SBETAT2
523 FORMAT(20K,*AAAAU=*,F10.6,2K,*B338U=*,F10.6,2K,*CCCCU=*,F10.6)
524 FORMAT(20K,*ABJ=*,F10.6,2K,*B8J=*,F10.6,2K,*C8J=*,F10.6,2K*D8U=*,1
  F10.5)
525 FORMAT(20K,*A2AAU=*,F10.6,2K,*B233J=*,F10.6,2K*C2CCJ=*,F10.6)
530 FORMAT(1F10.8)
531 FORMAT(10X,*DE_TAI,I,J)=*,7(F10.8,2K))
5330 FORMAT(20K,*THICKNESS OF PLATE CONVEX FOIL = *,F10.5,10X,*XXM=*,1
  F10.5)
535 FORMAT(20K,*R=*,F5.2*2*2K,*AAAAU=*,F10.6,2K,*B338=*,F10.6,2K,*CCCC=*,X
  F10.6)
536 FORMAT(20K,*AB=*,F10.6,2K,*B8=*,F10.6,2K,*C8=*,F10.6,2K*D8=*,F10.
  X5)
537 FORMAT(20K,*XRDJND=*,F10.6,2K,*A2AA=*,F10.6,2K,*B233=*,F10.6,2K,*C
  *2CC=*,F10.6)
795 FORMAT(8I10)
I AAAA,B338,CCCC ARE CONSTANTS FOR 2-TERM CAMBER, X AND SQR(X)
-----CALCULATED FROM ANOTHER PROGRAM CALLED *CAMBER-----.
I AB,B8,C8 AND D8 ARE COEFFICIENTS FOR POLYNOMIALS FOR X GREATER THAN .8.
I DO AND C2CC ARE NOW DUMMY.
I SF4 IS USED FOR DETERMINING WHETHER TO CALCULATE BETA.
1321 FORMAT(5E14.7)
I IFLAG=1 NEEDS DATA CARDS FOR SXSIC(I), I=1,5, IREAD MAY BE SET TO 5.
I IF IFLAG=0 , DATA WILL BE READ EITHER FROM
DATA CARD, IF IREAD=5
TAPE1 , IF IREAD=1.
531 FORMAT(10I3)
531 FORMAT(4I3)
532 FORMAT(4E14.7)

```

```

C DE, DG, DF ARE THE INCREMENTS FOR DERIVATIVES IN DX=NEW.
C D3=1.E-3 S DF=1.E-5 ARE USED BEFORE.
229 FORMAT(3E14.7)
1229 FORMAT(5X,4H-LP=,I4,2X,4H-LP<,I4,2X,6HSBETA=,E14.7,5X,6HIREAD=,I1,
    <2X,+NCHBY=*,I3)
5551 FORMAT(20X,+BETAB AND BETAC AS FIRST GUESS=*,F10.5,2X,F10.5)
1324 FORMAT(10X,3HDE=,E13.7,2X,34D5=,E14.7,3HDF=,E14.7,2X,4HSF4=,E14.7)
1521 FORMAT(10X,+S3ETA2=*,E14.7)
SBETA2=SBETA2*PAI/180.
BETAB=SBETA2*PAI/180.
BETAC=SBETA2*PAI/180.
C LP44=LPM2=VS2
LP44=LPM2
VS2=LP42
LPMM1=LPMM+1
WRITE(5,1489) LP42,I3HARP
1489 FORMAT(10X,+LP42=*,I3,2X+I3HARP=*,E14.7)
C ISHARP=0 FOR SHARP _E.
C     1 FOR ROUNDING _E.
SBETA=SBETA*PAI/180.
DO 999 IJKL=1,NITER
C FFF4 IS PROVIDED FROM DX=NEW, BUT IF THE LOOP DOES NOT GO THROUGH
C IT, FFF4 OF PRESET /ALFA MUST BE USED.
FFF4=0.
ALFA1D=ALFA1S
GA44AD=GA44AS
SOLID=SOLIS
IF(V4<.EQ.1) GO TO 242
IF(VH<.EQ.2) GO TO 241
SOLID=SOLID+0.1*FLJAT(IJKL-1)
GO TO 243
241 GA44AD=GA44AS+2.*FLJAT(IJKL-1)
GO TO 243
240 ALFA1D=ALFA1S-2.*FLJAT(IJKL-1)
243 CONTINUE
XM=XM4
ALFA1=ALFA1D*PAI/180.
DGAP=1./SOLID
GA44A=GA44AD*PAI/180.
DEALFA=ALFA1*G444A
FLAPAV=0.
WRITE(5,655) ALFA1D,GAMMAD,SOLID
555 FORMAT(1X,16HINCIDENCE ANGLE=,E14.7,1X,6HGAMMA=,E14.7,1X,9HSOLIDIT
    XY=,E14.7)
WRITE(5,653) FLAPAN
553 FORMAT(5X,11HFLAP AVG_E=,E14.7)
STAB=2.E-4
STOLS=5.E-4
ERC=1.E-2
CLE=1.E-4
WRITE(5,511) CAVLEN
511 FORMAT(10X,+CAVITY LENGTH=*,E14.7)
C SPECIFY HYDRO-OILS CHARACTERISTICS AND SEP. POINTS.
KC=0.
YC=0.
XB=0.
XA=1.
XXDD=1.00000
YYDD=A3U+B3J+C3J+D3J
WRITE(5,562) XA,XB,XC,YC,XXDD,YYDD

```

```

502 FORMAT(10X,5HCHDR)=,E14.7,2K,174JPPR SEP. POINT=,E14.7,2X,20HCNN
  X, POINT(XC,YC)=(,E14.7,1H,,E14.7,1H)/* XXDD=*,=10.5,2X,*YYDD=*,*
  Y=10.5)
C START ITERATIVE PROCEDURE.
C -----BASIC FLOW IS THAT OF PLATE-----.
C ITERAT IS INDEX FOR NUMBER OF ITERATIONS.
  ITERAT=1
  IF(IF_A3.E2.0) ITERAT=2
  BIGS=0.
  XHIGH=0.
  XLIN=0.
  IS1I2=0
  XINCRT=XA/50.
  DO 248 IINC=1,50
  XLIN=XHIGH
  CALL ARCLEN(S,XLIN,XHIGH,IS1I2)
  248 BIGS=BIGS+S
C -----FIND BIGS2-----
C         FIRST CALL SHAPE TO FIND A CORRESPONDING TO CAVLEN.
  XCCE=CAVLEN
  XFREEC=CAVLEN
  CALL SHAPE(CAVLEN,Y,BETA,3)
  YFREEC=Y
  YCC=Y
  CALL ARCS2(BIGS2,CAVLEN,Y)
  WRITE(6,504) BIGS2,BIGS2
  504 FORMAT(10X,5HBIGS=,E14.7,5X,*BIGS2=*,E14.7)
  STO_=1.E-5
  LPM=LPM_
  _P1=LPM_
  _P2=LPM-1
  _P3=LPM-3
C ICP1 IS USED FOR CONTROLLING PROGRAM 0 FOR ITER. 1 FOR THE REST.
C FIND XSIB,XSIF,XSIC,A,AL=A2 BY USING NEWTON'S METHOD.
C SXSI(1)=XSIB
C SXSI(2)=XSIC
C SXSI(3)=XSIF
C SXSI(4)=A WHICH IS THE COEFF. OF MAPPING FCN.
C SXSI(5)=ALF2
C SXSI(6)=SIGMA
C SXSI(7)=ESPACE (RATIO OF SPACE OF BLADES AT UPSTREAM AND DOWNSTREAM)      C
  IF(IJKL.GE.2) GO TO 530
  IF(IFLAG.EQ.0) GO TO 779
C INITIAL GUESS FOR SXSI(I) IS -----
  READ(5,763) SXSI(1),SXSI(2),SXSI(3),SXSI(4),SXSI(5),SXSI(6)
  X           ,SXSI(7)                                C
  GO TO 150
  779 READ(IREAD,520) SXSI(1),SXSI(2),SXSI(3),SXSI(4),SXSI(5),SXSI(6)
  X           ,SXSI(7)                                C
  520 FORMAT(7E10.7)
  521 DO 521 IC=1,LPM
  521 READ(IREAD,522) SAR2(IC),BETAN2(IC)
  522 FORMAT(2E14.7)
  DO 1521 IC=1,_P441
  1521 READ(IREAD,622) SAR2(IC),BETAN2(IC)
  IF(IF_A3.E2.0) GO TO 480
  GO TO 461
  430 DO 432 IBT=1,LPM
  432 BETAN4(GBT)=.5*(BETAN4(GBT)+BETAN(GBT+1))

```

```

431 CONTINUE
160 ICPI=3
  WRITE(6,102) ITERA
102 FORMAT(10X,14ITERATION NO.=,I2)
  DO 850 IRP=1,7
950 SXSI0(IRP)=SXSI(IRP)
  IF(ITERA.EQ.2) STOL=STOLS
  IF(ITERA.EQ.MSTOP) STOL=STOLL

      CALL DXFVIEW(SXSI,STOL,MAXIT,ITN,DS,DF,FFF4)

530 CONTINUE
  DO 537 I01=1,7
    XSN(I01)=SXSI(I01)
537 WRITE(6,535) I01,SXSI(I01)
536 FORMAT(10X,5HSXSI(+,I1,2H)=,+E14.7)
  CSPACE=(1.+SXSI(1))/FLDAT(_P)
  MCSPACE=0.5*CSPACE
  FSPACE=CSPACE*FLDAT(_P-M)
  HSPACE=0.5*SPACE
  XBET=-1.+CSPACE*FLDAT(LPK-1)
  ICPI=1

C ICPI=0 FOR FINDING SXSI(I), I.E., SXSI(I)=YXS(I) > ICPI=1 FOR THE REST.
C CALCULATION OF PRESSURE DISTRIBUTION TC?
  IF(ITERA.EQ.1) GO TO 36
  DO 35 IS=1,_P4
35 BETANO(I8)=BETAN(I8)
  DO 37 IS=1,_LPM1
37 BETAM0(I8)=BETA0(I8)
  DO 355 IE=1,_LPM41
355 BETA02(I8)=BETA02(I8)
36 CONTINUE
  JJ2=CLS(A_FA1+GA44A)/COS(SXSI(5)+SA44A)/SXSI(7)
  JJ22=JJ2**2
  DO 25 LG=1,_LPM
25 _P=_
C FIND CP(XSIP) NEXT.
C---- FOR THE FIRST JETTED ARC PORTION S1-----
C IS BASED ON U1 AND P1.
_P=1 IS NEAR THE T.E.
_P=_P4 IS NEAR THE L.E.
IF(_LP.EQ.1) GO TO 521
IF(_P.EQ._P4) GO TO 52
Q2=EXP(XITNL_P)
C XITNL_P IS CALCULATED IN DSKI42 OF DX=FV4 FOR F(4).
Q2=Q2**2
CP(_P)=1.-JJ22*Q2
GO TO 522
52 CP(_P)=SXSI(6)
GO TO 522
521 CP(_P)=1.-JU22
522 CONTINUE
25 CONTINUE

```

```

*****MAIN INSERT 1*****  

*  

*-----CP FOR THE SECOND ARC S2-----  

* NUMBER OF CONTROL POINTS ON S2 IS FIXED  

* IN SUBROUTINE DFSI45, I.E.,  

* HALF OF THE POINT USED FOR BETA  

* ANSG2S IN COMMON = S2.  

DO 680 NCP = 1,LPM41  

IF(NCP.EQ.1) GO TO 681  

IF (NCP.EQ.LPM41) GO TO 682  

S2 = EXP(ANSG2S(NCP))  

S2 = S2**2  

CP2(NCP) = 1.-S2*JJ22  

GO TO 680  

681 CP2(NCP)=SXSI(S)  

GO TO 680  

682 CP2(NCP) = 1.-JJ22  

690 CONTINUE  

*  

*****MAIN INSERT 1*****  

*  

AF4=ABS(FFF4)  

IF(AF4.GE.3E4) GO TO 1135  

GO TO 1134  

1135 WRITE(S,1135)  

1136 FORMAT(5X, F(4) IS TOO LARGE TO CALCULATE BETA*)  

STOP  

C F(XXX(XSIP) FIRST.  

1134 CONTINUE  

IS1S2=0  

-----FIRST BETA FOR ARC 1-----  

DO 100 L=1,LPM41  

LP=LPM-LP+1  

CALL BBBETA(XYX,BETA,IS1S2)  

XXX(LP)=XYX  

BETAN(LP)=BETA  

IF(L.P.EQ.1) BETAB=BETA  

IF(ITERA.E.MSTDP1) GO TO 100  

WRITE(S,101) LP,SARC(LP),XXX(LP),CP(LP),BETAN(LP)  

100 CONTINUE  

101 FORMAT(1X,2H1,I3,1X,5HSARC=,E14.7,1X,4HXXX=,E14.7,1X,3HCP=,E14.7,  

1X,5HBTAV=,E14.7)  

*  

*****MAIN INSERT 2*****  

*  

-----BETA FOR ARC S2-----  

* SARC HAS BEEN CALCULATED  

* IN SUBROUTINE DFSI45 AND  

* STORED IN COMMON AREA.  

IS1S2 = 1  

DO 429 L=1,LPM41  

LP=LP  

CALL BBBETA(XYX,BETA,IS1S2)  

IF(L.P.EQ.1) BETAC=BETA

```

```

XXX2(_P) = XYX
BETAV2(LP) = BETA
IF(ITERA.LE.MSTOP1) GO TO 329
WRITE(6,239) _P,SARC2(_P),XX2(_P),CP2(LP)+BETAV2(LP)
239 FORMAT(9X,*I=*,I3,1X,*SARC2=*,E14.7,1X,*XXX2=*,*
*E14.7,1X,*CP2=*,E14.7,1X,*BETAV2=*,E14.7)
329 CONTINUE
429 CONTINUE
:
*****MAIN INSERT 2 *****
:
*****MAIN INSERT 3 *****
:
FIND LIFT AND DRAG.
-----FIRST CL AND CD FOR S1 PART.
JS1D = SIN(DELTA)
JC0D = COS(DELTA)
JX3 = SXSI(4)*JC0D
JXB2 = JX3**2
DO 105 ITK = 1,_P4
IF(ITK.GT._PK) GO TO 106
XPS = -1.*CSPACE*FLDAT(ITK-1)
DO 108 108
XPS = XPS+CSPACE*FLDAT(ITK-_P)
108 C0VTFVJE
JXA = XPS-SXSI(4)*JS1D
JXA2 = JXA**2
PXXP = JC0D/(JXA2+UX32)
DXDX = DGAP*PXXP*XPS/PAI
C0BET1 = COS(BETAV(ITK))
S1BET1 = SIN(BETAV(ITK))
DS1DX = -EXP(-XITV(ITK))-DXDX/JJ22
GI IS CALCULATED AT DS1M2 , XITV(I).
AVG STORED IN COMMON.
IF(XPS.LT.0.) DS1DX = -DS1.
X_P1 = DS1DX*2P(ITK)
F_1(ITK) = -XLP1*C0BET1
F0(ITK) = XLP1*S1BET1
105 C0VTFVJE
-----CL AND CD FOR S2 PART.
VS21=VS2+1
VS2A=VS2-1
GAP2 = (S(SI(3)-SXSI(2))/VS2
DO 539 ITK = 1, VS21
XRS2 = SXSI(2)*GAP2*(ITK-1)
JKA = XRS2-SXSI(4)*JS1D
JXA2 = UX4**2
PXXP = JC0D/(JXA2+JX32)
DXDX = DGAP*PXXP*XRS2/PAI
C0BET2 = -COS(BETAV2(ITK))
S1BET2 = -SIN(BETAV2(ITK))
DS2DX = EXP(-ANSG2S(ITK))+DXDX/JJ22
32 IS ALREADY CALCULATED AT DS1M5 AS
AVSG2S(I), STORED IN COMMON AREA.
X_P2 = DS2DX*CP2(ITK)
F_2(ITK) = -XLP2*C0BET2
F02(ITK) = X_P2*S1BET2

```

```

553 CONTINUE
SPACE = CSPACE
CLIFT = 0.5*CSPACE+F_(2)+0.5*FSPACE+FL(LPM1)
CDRAG = 0.5*CSPACE+F_(2)+0.5*FSPACE+FD(LPM1)
DO 111 IUA = 2, P#3, 2
IF(IUA.GE._PK) SPACE = FSPACE
CLIFT = CLIFT+SPACE*(F_(IJA)+4.+F_(IJA+1)+F_(IJA+2))/3.
111 CDRAG = CDRAG+SPACE*(F_(IJA)+4.+F_(IJA+1)+F_(IJA+2))/3.
DO 321 IUA = 1, NSZA, 2
CLIFT = CLIFT+GAP2*(F_2(IJA)+4.+F_2(IJA+1)+F_2(IJA+2))/3.
321 CDRAG = CDRAG+GAP2*(F_2(IJA)+4.+F_2(IJA+1)+F_2(IJA+2))/3.
-----ADD THE FORCES ON CAVITY PORTIONS.
SUBROUTINE XCYC CALCULATES
THE POINT ON THE UPPER BLADE PORTION CORRESP. TO THE CAVITY END POINT.
XKA=XCCC
CYA=YCCC
CALL XCYC(XCCC,B,YCCC,B,XKA,CYA)
CLIFT = CLIFT+SXS1(5)*XCCC
CDRAG = CDRAG-SXS1(5)*YCCC
-----XCCC AND YCCC ARE THE END POINTS OF CAVITY, CALCULATED IN
SUBROUTINE CAVITY
STORED IN COMMVA.
*
*-----MAIN INSERT 3 -----
*
* F(ND) BINF IN 2-1.
J2J1=COS(ALFA1+GAMMA)/COS(SXS1(5)+GAMMA)/SXS1(7)
DDIN=COS(ALFA1+GAMMA)*COS(SXS1(5)+GAMMA)
BINF=0.5*SIN(ALFA1+SXS1(5)+2.*GAMMA)/DDIN
BINF=ATAN(1./BINF)
AIVF=0.5*PAI-BINF-GAMMA
COSTAR AND ALSTAR ARE BASED ON VELOCITY AT JSTREAM INFINITY IN (X,Y).
COSTAR=CDRAG
ALSTAR=CLIFT
UINF=0.5*SQRT(1.+J2J1**2+U2J1*COS(ALFA1-SXS1(5)))
FIVF=2.*DGAP*SIN(ALFA1-SXS1(5))/(J1VF+COS(SXS1(5)+GAMMA))
CLINVF=CLSTAR*COS(AIVF)-COSTAR*SIN(AIVF)
CDIVVF=CLSTAR*SIN(AIVF)+COSTAR*COS(AIVF)
C_INVF=CLINVF/UINF**2
CDIVVF=CDIVVF/UINF**2
WRITE(6,117) CLINVF,CDIVVF
117 FORMAT(1X,34HCLINF DR CDIVF=FORCE/1/2RD.0,UINF**2,5X,6HCLINF=,E14.7,
X14.6HCDINF=,E14.7)
WRITE(6,118) FIVF
118 FORMAT(1X,34HFIVF IS OBTAINED FROM 404ENTJ4 E2N+54FINF=,E14.7)
WRITE(6,221)
221 FORMAT(1X,48H---CCD_ S CCD ARE BASED ON U1 IN ALFA1 DIRE.---)
CCD_=CLSTAR*COS(ALFA1)-COSTAR*SIN(ALFA1)
CCD_=CLSTAR*SIN(ALFA1)+COSTAR*COS(ALFA1)
ALDD=CCD_/CCD_
WRITE(6,181) CCD_,CCD_,ALDD
181 FORMAT(1X,54CCD=,E14.7,1X,54CCD=,E14.7,1X,44L/D=,E14.7)
MSTJP1=MSTJP1-1
IF(MSTJP1.EQ.0) GO TO 140
*
*-----MAIN INSERT 4 -----

```

AD-A081 832

TETRA TECH INC PASADENA CA
COMPUTER PROGRAMS FOR CALCULATING PARTIALLY CAVITATING BLUNT TR--ETC(U)
JAN 80 S MAEKAWA, O FURUYA
TETRAT-TC-3284-02

F/G 9/2

N00014-79-C-0234

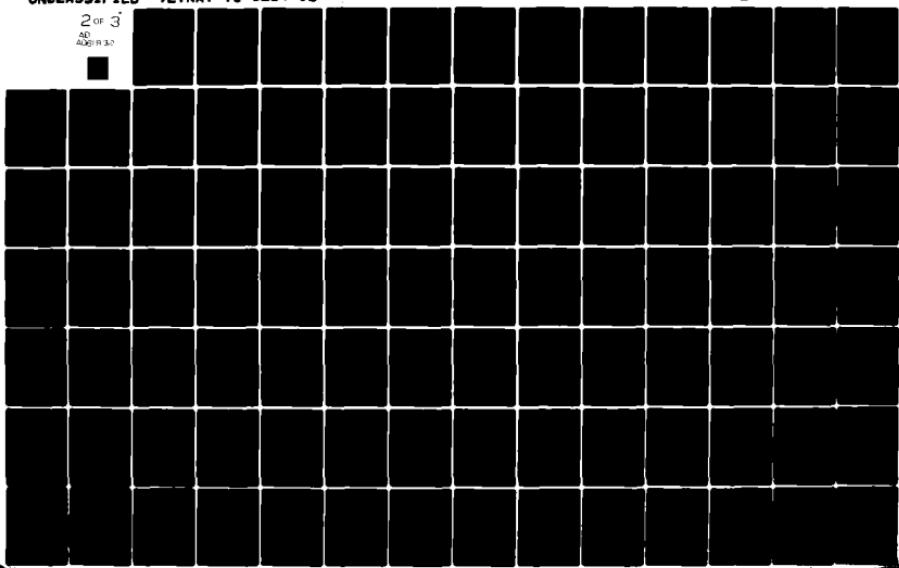
NL

UNCLASSIFIED

2 of 3

AD
0209 R 3.0

[Redacted]



```

      CAVITY SHAPE.
      ALREADY CALCULATED IN
      SUPERJETIVE CAVITY.
      WRITE(5,297)
237 FORMAT(2X,*---CAVITY SHAPE----*)
      VCAV1=VCAV+1
      DO 295 CCAV=1,NCAV1,2
235 WRITE(5,235) CAVX(CCAV),CAVY(CCAV)
236 FORMAT(10X,*X=*,E14.7,10X,*Y=*,E14.7)

*****MAIN INSERT 4 *****

140 CONTINUE
      XCCC=0.
      YCCC=0.
      WRITE(5,823)
923 FORMAT(//,*-----JP00R BODY SHAPE-----)
      DO 321 IS4P=1,51
      X=.02*(IS4P-1)
      CALL SHAPE(X,Y,BETA,3)
321 WRITE(5,822) X,Y
322 FORMAT(5X,*X=*,F10.5,*Y=*,F10.5)
      RE=IND 7
      WRITE(7,753) SXSI(1),SXSI(2),SXSI(3),SXSI(4),SXSI(5),SXSI(6)
      X ,SXSI(7)
753 FORMAT(7F10.7)
      DO 765 IC=1,L24
756 WRITE(7,767) SARC(IC),BETAN(IC)
757 FORMAT(2E14.7)
      DO 1766 IC=1,LPMM1
1755 WRITE(7,757) SARC2(IC),BETAV2(IC)
      IF(LTERA.EQ.MSTD) GO TO 933
      LPK1=LPK-1
      SPACE=CSPACE
      HSPACE=HCSPACE
      DO 50 IM=1,-P41
      IF(IM.EQ.1) GO TO 51
      IF(IM.EQ.-P41) GO TO 55
      IF(IM.EQ.-P<1) GO TO 57
      IF(IM.EQ.P<) GO TO 58
      IF(IM.EQ.-P>) GO TO 53
      XY=-1.*SPACE+FLOAT(IM-1)*HSPACE
      XZ(1)=-1.*SPACE+FLOAT(IM-2)
      XZ(2)=XZ(1)+SPACE
      XZ(3)=XZ(2)+SPACE
      XZ(4)=XZ(3)+SPACE
      GO TO 99
53 SPACE="SPACE
      HSPACE=HFSPACE
      XY=XBET+HSPACE+ SPACE+FLOAT(IM-LPK)
      XZ(1)=XBET+SPACE+FLOAT(IM-LPK-1)
      XZ(2)=XZ(1)+SPACE
      XZ(3)=XZ(2)+SPACE
      XZ(4)=XZ(3)+SPACE
59 DO 36 IK=1,4
36 YBE(IK)=BETAN(IM+IK-2)
      BETAN(IM)=AIT(EV(XZ,YBE,XY,3))

```

```

33 TO 151
37 BETAM(_PK1)=0.5*(BETAV(LP<1)+BETAN(_PK))
33 TO 151
38 BETAM(LPK)=0.5*(BETAV(LP<) +BETAN(LP<+1))
33 TO 151
51 BETAM(1)=0.5*(BETAN(1)+BETAV(2))
33 TO 151
55 BETAM(_PM1)=0.5*(BETAV(LP41)+BETAN(_P4))
151 CONTINUE
50 CONTINUE
IF(ITERA.EQ.1) GO TO 6
33 41 IE=1,LPM
41 BETAN(IE)=BETAN(IE)*(1.-XXM)+BETAN0(IE)*XXM
33 42 IFG=1,LPM
42 BETAM(IFG)=BETAM(IFG)*(1.-((4)+BETA4D(IFG))*XXM
33 425 IFG=1,LPM
425 BETAV2(IFG)=BETAV2(IFG)*(1.-XXM)+BETA02(IFG)*XXM
33 652 IRP=1,7
352 SXSI(IRP)=SXSI(IRP)*(1.-XXM)+SXSI0(IRP)*XXM
6 ITERA=ITERA+1
IF(ITERA.GT.MSTOP) GO TO 29
33 TO 160
29 WRITE(6,29)
29 FJRMAT(3X,25HITERATION WAS TERMINATED.)
399 CONTINUE
STOP
END

```

```

SJ3ROUTINE JX=NEW(X,STDL,4,I,JG,DF,-FFF4)
DIMENSION F(7),Q(50,7),X(7),Q(7,7),KRRI(7),XMMI(7)
C0440V /CVTYL/CAVLEV,BIGS2
C0440V/FREECAV/XFREEC,Y=REEC
C0440V YCEC,S3ET42
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
C0440V CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),ISHAR3,NCHBY,BBTAN(130),BBTAN2(100),BETAN2(100)
C0440V FLAPAV,DELTAB,BAP,ALFA1,GA4MA
C0440V SBETA,449,ICPI,SARCO(513)
C0440V IDJL,XA,XB,XC,TANG,EP,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
C0440V XSV(7),  
CL,ERC,YYY,K4,IFERA,SXSID(7),SXSIOD(7),YXS(7)
COMMON PSIZ,LP,SARC(513),SARCO(513),LPM,DE
C0440V BETAV(513),BETA4(513),IJ,LPK,XII(200),JJ(200),XJX
C0440V XR0JND,A2AA,3239,C2CC
C0440V AAAA,BB33,CCCC,A8+32,C9,JB,T3AJS(100),J3AUS(100),NGAUS
PAI=3.141592653
I=0
I=(IFERA-.E.3) GO TO 272
DO 67 IIJ=1,7
57 WRITE(S,65) IIJ,X(IIJ)
56 FDR4AT(1X,24X,(I1,24)=.E14.7)
272 CONTINUE
55 SII=2.*DE
SI6=2.*D6
I=(X(1)-.T.SII) X(1)=SII
SI10=X(1)+2.*D6
I=(X(2)-.T.SI10) X(2)=SI10
SI11=X(2)+2.*D6
I=(X(3)-.T.SI11) X(3)=SI11
I=(X(4)-.T.SI12) X(4)=SI12
SI5=(0.5+PAI-GAMMA)+(1.-0.02)
I=(X(5).LT.0.) GO TO 79
I=(X(5).GT.SI5) X(5)=SI5
GO TO 79
78 I=(ABS(X(5)).GT.SI5) X(5)=-SI5
79 CONTINUE
I=(X(7).LT.0.) WRITE(S,1123)
1123 FORMAT(2X,-----X(7) IS LESS THAN ZERO-----)
I=(X(5).LE..001) X(5)=.001
DO 68 IIJ=1,7
69 WRITE(S,65) IIJ,X(IIJ)
IJ=1
-----F(1)-----
DO 20 I<=1,7
20 YXS(IK)=X(IK)
5 CONTINUE
KCTRL = 1
CALL "IINT_(YINT1,KCTRL)
SUBROUTINE IINT1 CALCULATES THE INTEGRALS IN F(1).
KCTRL = 2
CALL "IINT_(YINT2,KCTRL)
KCTRL = 3
CALL "IINT_(YINT3,KCTRL)
KCTRL = 4
CALL "IINT_(YINT4,KCTRL)
CCC1=4.0*G(1.+YXS(6))/(2.*PAI)
CS1 = ALOG(COS(YXS(5)+BA4MA)/COS(A-.F41+BA4MA)+YXS(7))
FA = -(YINT1*PAI+YINT2-(CCC1*CS1*PAI)+YINT3

```

```

1+YINT4/PAI-YXS(5)
I= (IJ.EQ.1) WRITE (5,70) YINT1,YINT2,YINT3,YINT4
70 FORMAT (10X,*,I1,I2,I3,I4) F=(1) ARE---*,4(E14.7,2X))
I= (IJ.EQ.1) F(1) = FA
I= (IJ.EQ.2) S0 TD 3
I= (IJ.EQ.3) S0 TD 4
I= (IJ.EQ.4) S0 TD 320
I= (IJ.EQ.5) S0 TD 321
I= (IJ.EQ.6) S0 TD 322
IF(IJ.EQ.56) GO TD 3222
P(1,5) = TAN(YXS(5)+GAMMA)+YINT3/PAI-1.
P(1,6)=-YINT3/(2.*PAI*(1.+YXS(6)))
P(1,7)=-YINT3/(PAI*YXS(7))
IJ = 2
YXS(1) = X(1)+DELT(1,1)
S0 TD 5
3 F1P = -FA
IJ = 3
YXS(1) = X(1)-DELT(1,1)
S0 TD 5
4 F12 = -FA
P(1,1) = (F1P-F1Q)/(2.*DELT(1,1))
IJ = 4
YXS(1) = X(1)
YXS(2) = X(2)+DELT(1,2)
S0 TD 5
320 F1P = -FA
YXS(2) = X(2)-DELT(1,2)
IJ = 5
S0 TD 5
321 F12 = -FA
P(1,2) = (F1P-F1Q)/(2.*DELT(1,2))
YXS(2) = X(2)
YXS(3) = X(3)+DELT(1,3)
IJ = 5
S0 TD 5
322 F1P = -FA
IJ=66
YXS(3)=X(3)-DELT(1,3)
S0 TD 5
3222 F1Q=-FA
YXS(3)=X(3)
P(1,3) = (F1P-F1Q)/(2.*DELT(1,3))
P(1,4) = 0.
-----F(2) AND F(3)-----
IJ = 7
330 CONTINUE
XXXX = ALJS(COS(ALFA1+GAMMA)/COS(YXS(5)+GAMMA)/YXS(7))
XX1 = YXS(5)*SIN(D-E-TA)
YY1 = YXS(4)*COS(D-E-TA)
YY12=YY1**2
CCCI=ALOG(1.+YXS(6))/(2.*PAI)
CDN1 = CCC1-XXXX/PAI
RRR = 0.
XMM = 0.
JJ 331 MIQ = 1*4
CALL RMINT(SOLNR,SOLV4,MIQ)
XRR1(4I3) = S3_VR
X44I (4IQ) = SOLN4
XRRR = -XRR1(MIQ)/PAI

```

```

X44I = -X44I(4I3)/PAI
IF (M10.E3.1) XRRR = C0N1*XRR1(M13)
IF (M12.E3.1) XM44 = C0V1*X44I(4I3)
IF (M10.E3.4) XRRR = -XRR1(4I3)
IF (M12.E3.4) XM44 = -X44I(4I3)
IF (IJ.EG.7) WRITE (6,71) ((RRI(I), I=1,4)
IF (IJ.EG.7) WRITE (6,72) ((44I(I), I=1,4)
71 = D24AT(10K,---XRR1(I), I=1,4) DF F(2) AND F(3) ARE---,4(E14.7,2X)
72 = D24AT(10K,---XM44(I), I=1,4) DF F(2) AND F(3) ARE---,4(E14.7,2X)
XRR = XRR+XRRR
XM44 = XM44+XM44R
331 CONTINUE
-----CALCJ-AT13N OF 41(ZET41)-----
XSIP1 = XX1**1.
XS143 = XX1-YXS(1)
XS14F = XX1-YXS(3)
XS14C = XX1-YXS(2)
XSIP12 = XSIP1**2
XS1432 = XS143**2
XS14F2 = XS14F**2
XS14C2 = XSIMC**2
RRA = SQRT(XSIP12*YY12)
RRB = SQRT(XSIMB2*YY12)
RRC = SQRT(XSIMF2*YY12)
RRD = SQRT(XSIMC2*YY12)
T4IA = ATAN(YY1/XSIP1)
IF (XSIP1.E.0.) T4IA = PAI+T4IA
TH13 = ATAN(YY1/XS143)
IF (XS143.E.0.) TH13 = PAI+T4IA
TH1C = ATAN(YY1/XS14F)
IF (XS14F.E.0.) TH1C = PAI+T4IC
T4ID = ATAN(YY1/XS14C)
IF (XS14C.E.0.) TH1D = PAI+T4ID
RR1 = SQR(RRA+RRB+RRC+RRD)
THIT1 = .5*(THIA+TH13+TH1C-TH1D)
CDT41 = CDS(THIT1)
SIT41 = SIV(THIT1)
F2CJ = RR1*(XRR+CJF41-X44+SIT41)-A-EA1
F3CJ = RR1*(XRR+SIT41+X44+CJTH1)+<<<
IF (IJ.EG.7) F(2) = -F2CJ
IF (IJ.EG.7) F(3) = -F3CJ
IF (IJ.EG.9) 60 TO 340
IF (IJ.EG.9) 30 TO 341
IF (IJ.EG.10) 60 TO 342
IF (IJ.EG.11) 60 TO 343
IF (IJ.EG.12) 60 TO 344
IF (IJ.EG.13) 60 TO 345
IF (IJ.EG.14) 60 TO 346
IF (IJ.EG.15) 60 TO 347
TA23 = TAN(YXS(5)+SA44A)
XCXS = XRR1(1)*CJTH1 - X44I(1)*SITH1
XSXC = XRR1(1)*SIT41 + X44I(1)*CJTH1
P(2,5) = -RR1*TA26+CS(S
P(2,5) = P(2,5)/PAI
P(3,5) = -RR1*TA23+CS(C
P(3,5) = P(3,5)/PAI+TA23
3*Y=2.*PAI*(1.+YXS(5))
P(2,6)=RR1*(XRR1(1)*CJTH1-X44I(1)*SITH1)/8PY
P(3,6)=RR1*(XRR1(1)*SIT41+X44I(1)*CJTH1)/8PY
P(2,7) = RR1*XCXS/(1.+YXS(7))

```

```

R(3,7) = R31*XSXG/(#4I+YXS(7)) - 1./YXS(7)
IJ = 3
YXS(1) = X(1)+DELT(1+2)
GO TO 330
340 #2 = F2C0
#3 = F3C0
IJ = 3
YXS(1) = X(1)-DELT(2+1)
GO TO 330
341 P(2,1) = (FP2-F2C0)/(2.+DELT(2,1))
#(3,1) = (#3-F3C0)/(2.+DELT(2,1))
YXS(1) = X(1)
YXS(2) = X(2)+DELT(2+2)
IJ = 10
GO TO 330
342 #2 = F2C0
FP3 = F3C0
YXS(2) = X(2)-DELT(2+2)
IJ=11
GO TO 330
343 #(2,2) = (FP2-F2C0)/(2.+DELT(2,2))
P(3,2) = (#3-F3C0)/(2.+DELT(2,2))
YXS(2) = X(2)
YXS(3) = X(3)+DELT(2+3)
IJ = 12
GO TO 330
344 #2 = F2C0
#3 = F3C0
YXS(3) = X(3)-DELT(2+3)
IJ = 13
GO TO 330
345 #(2,3) = (FP2-F2C0)/(2.+DELT(2,3))
P(3,3) = (#3-F3C0)/(2.+DELT(2,3))
YXS(4) = X(4)+DELT(2+4)
YXS(3)=X(3)
IJ=14
GO TO 330
346 FP2=F2C0
#3=F3C0
YXS(4) = X(4)-DELT(2+4)
IJ = 15
GO TO 330
347 P(2,4) = (FP2-F2C0)/(2.+DELT(2,4))
#(3,4) = (#3-F3C0)/(2.+DELT(2,4))
YXS(4)=X(4)
-----F(4)-----
IJ=16
YXS(1)=X(1)+DELT(4+1)
133 CAL_ J=SI42(AVS2)
IF(IJ.EQ.16) GO TO 513
IF(IJ.EQ.17) GO TO 514
IF(IJ.EQ.18) GO TO 575
IF(IJ.EQ.19) GO TO 515
IF(IJ.EQ.20) GO TO 515
IF(IJ.EQ.21) GO TO 517
IF(IJ.EQ.22) GO TO 513
IF(IJ.EQ.23) GO TO 521
IF(IJ.EQ.24) GO TO 522
IF(IJ.EQ.25) GO TO 523
IF(IJ.EQ.26) GO TO 524

```

```

IF(IJ.EQ.251) GO TO 5241
IF(IJ.EQ.262) GO TO 5242
IF (IJ.EQ.271) GO TO 5251
IF (IJ.EQ.272) GO TO 5252
513 ANSP=ANS2
IJ=17
YXS(1)=X(1)-DELT(4,1)
GO TO 199
514 ANS2=ANS2
IJ=18
P(4,1)=-(ANSPLANSQ)/(2.*DELT(4,1))
YXS(1)=X(1)
GO TO 199
515 ANSF=ANSP
=(4)=-(3*35-ANSP)
IJ=19
YXS(2)=X(2)+DELT(4,2)*ABS(X(2))
GO TO 199
516 ANSGG=ANS2
IJ=20
YXS(2)=X(2)-DELT(4,2)*ABS(X(2))
GO TO 199
517 ANS1P=ANSP
IJ=21
YXS(3)=X(3)+DELT(4,3)*X(3)
GO TO 199
518 ANS1D=ANSP
IJ=22
YXS(3)=X(3)-DELT(4,3)*X(3)
GO TO 199
519 ANS1D=ANSP
P(4,3)=-(ANSP-ANS1D)/62.*DELT(4,3)*X(3)
YXS(3)=X(3)
IJ=23
YXS(4)=X(4)+DELT(4,4)*ABS(X(4))
GO TO 199
521 ANA=ANSP
IJ=24
YXS(4)=X(4)-DELT(4,4)*ABS(X(4))
GO TO 199
522 ANB=ANSP
P(4,4)=-(ANA-ANB)/(2.*DELT(4,4)*ABS(X(4)))
YXS(4)=X(4)
IJ=25
YXS(5)=X(5)+DELT(4,5)
GO TO 199
523 ANC=ANSP
IJ=26
YXS(5)=X(5)-DELT(4,5)
GO TO 199
524 ANC=ANSP
=(4,5)=-(3*NA-3NB)/(2.*DELT(4,5))
YXS(5)=X(5)
EEF4ZC(4)
YXS(5)=X(5)
YXS(6)=X(6)+DELT(4,5)
IJ=251
GO TO 199

```

```

S241 3VA=AVS2
IJ=262
YXS(6)=X(6)-DELT(4,6)
GO TO 199
S242 BN8=ANS2
P(4,6)=-{3VA-3V3)/(2.*DELT(4,6))
YXS(6)=X(6)
IJ=271
YXS(7)=X(7)+DELT(4,7)
GO TO 199
S251 3VA=AVS2
YXS(7)=X(7)-DELT(4,7)
IJ=272
GO TO 199
S252 3V3=AVS2
P(4,7)=-{3VA-3V3)/(2.*DELT(4,7))
YXS(7)=X(7)
-----F(5) AND F(7)-----
C THIS SUBROUTINE FINDS THE END POINT OF CAVITY.
IJ = 27
315 CALL CAVITY (XCEND,YCEND)
F(7)=YCEND - FUNCTON(XCEND) = 0 TO BE SATISFIED
IS1I2 = 3
CALL SHAPE(XCEND,YUPPER,BETA,IS1I2)
IF(IJ.EQ.27) GO TO 320
IF(IJ.EQ.28) GO TO 321
IF (IJ.EQ.29) GO TO 322
IF (IJ.EQ.30) GO TO 323
IF (IJ.EQ.31) GO TO 324
IF (IJ.EQ.32) GO TO 325
IF (IJ.EQ.33) GO TO 326
IF (IJ.EQ.34) GO TO 327
IF(IJ.EQ.341) GO TO 330
IF (IJ.EQ.35) GO TO 328
IF (IJ.EQ.36) GO TO 329
IF (IJ.EQ.37) GO TO 340
IF (IJ.EQ.38) GO TO 341
IF (IJ.EQ.60) GO TO 1979
IF (IJ.EQ.61) GO TO 1980
S26 F(5)=-{XCEND-CAVLEN)
F(7) = -(YCEND-YUPPER)
IJ = 28
YXS(1) = X(1)+DELT(5,1)
GO TO 315
S21 ANP=XCEND
ANP7=YCEND-YUPPER
IJ = 29
YXS(1) = X(1)+DELT(5,1)
GO TO 315
S22 P(5,1)=(ANP-XCEND)/(2.*DELT(5,1))
ANP7=YCEND-YUPPER
P(7,1) = (ANP7-ANP7)/(2.*DELT(5,1))
YXS(1) = X(1)
YXS(2) = X(2)+DELT(5,2)*ABS(X(2))
IJ = 30
GO TO 315
S23 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(2) = X(2)-DELT(5,2)*ABS(X(2))
IJ = 31

```

```

33 TO 315
324 P(5,2)=(ANP-XCEND)/(2.*DELT(5,2)*ABS(X(2)))
AN27=YCEND-YJPER
P(7,2) = (ANP7-ANG7)/(2.*DELT(5,2)*ABS(X(2)))
YXS(2) = X(2)
IJ = 32
YXS(3) = X(3)+DELT(5,3)*X(3)
33 TO 315
325 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(3) = X(3)-DELT(5,3)*X(3)
IJ = 33
GO TO 315
326 P(5,3)=(ANP-XCEND)/(2.*DELT(5,3)*X(3))
AN27=YCEND-YUPPER
P(7,3) = (ANP7-AN27)/(2.*DELT(5,3)*X(3))
IJ = 34
YXS(3) = X(3)
YXS(4) = X(4)+DELT(5,4)*ABS(X(4))
GO TO 315
327 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(4) = X(4)-DELT(5,4)*ABS(X(4))
IJ=341
GO TO 315
328 CONTINUE
P(5,4)=(ANP-XCEND)/(2.*DELT(5,4)*ABS(X(4)))
AN27=YCEND-YUPPER
S(7,4) = (ANP7-AN27)/(2.*DELT(5,4)*ABS(X(4)))
YXS(4) = X(4)
YXS(5) = X(5)+DELT(5,5)
IJ = 35
33 TO 315
329 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(5) = X(5)-DELT(5,5)
IJ = 36
33 TO 315
330 P(5,5)=(ANP-XCEND)/(2.*DELT(5,5))
AN27=YCEND-YUPPER
P(7,5) = (ANP7-AN27)/(2.*DELT(5,5))
YXS(5)=X(5)
YXS(6)=X(5)+DELT(5,6)
IJ=37
33 TO 315
331 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(6)=X(5)-DELT(5,6)
IJ=38
33 TO 315
332 P(5,6)=(ANP-XCEND)/(2.*DELT(5,6))
YXS(6)=X(5)
ANG7=YCEND-YUPPER
S(7,6) = (ANP7-AN27)/(2.*DELT(5,6))
YXS(7)=X(7)+DELT(5,7)
IJ=39
33 TO 315
333 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(7) = X(7) - DELT(5,7)

```

```

IJ=51
330 TO 315
1330 P(5,7)=(ANP-XCEND)/(2.*DELT(5,7))
AN7=YCE\J-YJP PER
P(7,7) = (ANPT-AN7)/(2.*DELT(5,7))
YXS(7)=X(7)
C-----F(5)-L-----
IJ=40
330 CALL DFSI45(ANSS5)
IF(IJ.EQ.40) GO TO 331
IF(IJ.EQ.41) GO TO 332
IF(IJ.EQ.42) GO TO 333
IF(IJ.EQ.43) GO TO 334
IF(IJ.EQ.44) GO TO 335
IF(IJ.EQ.45) GO TO 336
IF(IJ.EQ.46) GO TO 337
IF(IJ.EQ.47) GO TO 338
IF(IJ.EQ.48) GO TO 339
IF(IJ.EQ.49) GO TO 340
IF(IJ.EQ.50) GO TO 341
IF(IJ.EQ.51) GO TO 342
IF(IJ.EQ.52) GO TO 343
IF(IJ.EQ.53) GO TO 1364
IF(IJ.EQ.54) GO TO 1365
331 =(6)=-(ANSS5-BIGS2)
IJ=41
YXS(1)=X(1)+DELT(5+1)
33 TO 350
352 ANP=ANSS
IJ=42
YXS(1)=X(1)-DELT(5+1)
33 TO 350
353 P(6,1)=(ANP-ANSS)/(2.*DELT(5,1))
YXS(1)=X(1)
IJ=43
YXS(2)=X(2)+DELT(5+2)
33 TO 350
354 ANP=ANSS
IJ=44
YXS(2)=X(2)-DELT(5+2)
33 TO 350
355 P(5,2)=(ANP-ANSS)/(2.*DELT(5,2))
IJ=45
YXS(2)=X(2)
YXS(3)=X(3)+DELT(5,3)
33 TO 350
356 ANP=ANSS
IJ=46
YXS(3)=X(3)-DELT(5,3)
33 TO 350
357 P(5,3)=(ANP-ANSS)/(2.*DELT(5,3))
IJ=47
YXS(3)=X(3)
YXS(4)=X(4)+DELT(5,4)
33 TO 350
358 ANP=ANSS
IJ=48
YXS(4)=X(4)-DELT(5,4)
33 TO 350
359 P(5,4)=(ANP-ANSS)/(2.*DELT(5,4))

```

```

IJ=49
YXS(4)=X(4)
YXS(5)=X(5)+DELT(5,5)
GO TO 350
350 ANP=ANSS
IJ=50
YXS(5)=X(5)-DELT(5,5)
GO TO 850
351 P(6,5)=(ANP-ANSS)/(2.*DELT(6,5))
YXS(6)=X(6)
YXS(6)=X(6)+DELT(6,6)
IJ=51
GO TO 850
352 ANP=ANSS
YXS(6)=X(6)-DELT(6,6)
IJ=52
GO TO 350
353 P(6,6)=(ANP-ANSS)/(2.*DELT(6,6))
YXS(6)=X(6)
YXS(6)=X(6)+DELT(6,7)
IJ=53
GO TO 850
1354 ANP=ANSS
IJ=54
YXS(6)=X(6)-DELT(6,7)
GO TO 350
1355 P(6,7)=(ANP-ANSS)/(2.*DELT(6,7))
YXS(7)=X(7)
DO 666 IK=1,7
666 WRITE(5,667) P(IK,J),J=1,7
667 FORMAT(3X,*(I,J)=*,7(E14.7,2X))
NCAV1=NCAV+1
DO 253 ICV=1,NCAV1,2
253 WRITE(5,252) CAVX(ICV),CAVY(ICV)
252 FORMAT(10X,*CAVX=*,F10.5,F10.5)
DO 129 ITX=1,7
129 WRITE(5,131) ITX,P(ITX)
131 FORMAT(1X,24F(I1,24)=,E14.7)
DO 132 IUP=1,7
1F(ITERA..E3) GO TO 385
DO 132 IUG=1,7
132 WRITE(5,133) IUP,IUJ,P(IUP,IUJ)
133 FORMAT(1X,24F(I1+14+I1+24)=,E14.7)
385 CONTINUE
CAL_ JETER4(P,7,DET3)
DO 25 IDET=1,7
DO 26 LPG=1,7
Q(LPG,IDEF)=P(LPG,IDEF)
26 P(LPG,IDEF)=F(LPG)
CAL_ JETER4(P,7,DET3)
IF(IDEF.E3,1) DELB=JETER/DET30
IF(IDEF.E3,2) DELC=JETER/DET30
IF(IDEF.E3,3) DELD=JETER/DET30
IF(IDEF.E3,4) DELE=JETER/DET30
IF(IDEF.E3,5) DELF=JETER/DET30
IF(IDEF.E3,6) DELG=JETER/DET30
IF(IDEF.E3,7) DELH=JETER/DET30
DO 27 LPG=1,7
27 P(LPG,IDEF)=Q(LPG,IDEF)
25 CONTINUE

```

```

X(1)=X(1)+DEL3
X(2)=X(2)+DEL6
X(3)=X(3)+DEL9
X(4)=X(4)+DEL6
X(5)=X(5)+DEL9
X(6)=X(6)+DEL6
X(7)=X(7)+DEL9
DO 50 MN=1,7
50 WRITE(6,61) L4N,X(L4N)
51 FORMAT(1X,2X,(I1,2I1),E14.7)
ABSB=ABS(JE-B/X(1))
ABSC=ABS(JE-C/X(2))
ABSD=ABS(JE-D/X(3))
ABSE=ABS(JE-E/X(4))
ABSF=ABS(JE-F/X(5))
ABSG=ABS(JE-H/X(7))
ABSG=ABS(JE-G/X(6))
EI1=0
IF(ABSB.LT.STOL) EI1=1
IF(ABSC.GT.STOL) EI1=0
IF(ABSD.GT.STOL) EI1=0
IF(ABSE.GT.STOL) EI1=0
IF(ABSF.GT.STOL) EI1=0
IF(ABSG.GT.STOL) EI1=0
IF(ABSG1.GT.STOL) EI1=0
IF(EI1.EQ.1) GO TO 35
I=I+1
WRITE(6,42) I
42 FORMAT(20X,14HITERATION NO.=,I2)
IF(EI1.EQ.1) GO TO 35
50 TO 55
55 I=I+1 GO TO 35
55 TO 38
56 WRITE(6,37)
57 FORMAT(1X,34HDX NEW DID NOT CONVERGE WITHIN 14T)
I=(X(1)+T*SI1) X(1)=SI1
SI10=(X(1)+2.*DG
I=(X(2)+T*SI10) X(2)=SI10
SI11=(X(2)+2.*DG
I=(X(3)+T*SI11) X(3)=SI11
I=(X(5)+T*SI11) X(5)=1.E-3
I=(X(4)+T*SI5) X(4)=SI6
SI5=(.5*(I-GAMMA)*(1.-.02)
I=(X(5)+T*0.) GO TO 31
I=(X(5).GT.SI5) X(5)=SI5
30 TO 32
31 IF(ABS(X(5)).GT.SI5) X(5)=-SI5
32 CONTINUE
I=(X(7).LT.0.) WRITE(6,1122)
1122 FORMAT(2X,-----X(7) BECAME LESS THAN ZERO-----)
33 RETURN
END

```

**

```

SUBROUTINE DFSI41(ANS,VDF,XCA)
DIMENSION XST(7)
COMMON YC55,SBETA2
COMMON XITV(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAJ,_PMM,NS2
COMMON AJ(100),ISHAR3,NCHBY,BETAV(100),BETAV2(100),BETAV4(100)
COMMON FLAPAN,DELTA,JGAP,ALFA1,GAMMA
COMMON Sbeta1,((1,ICPI,SRC0)(513))
COMMON IDUL,XA,XB,XC,TANG,EP,YC,YR,BIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSV(7),OLE,ERC,YYY,KM,ITERA,SXSID(7),SXSIOD(7),YXS(7)
COMMON PSIZ,LPM,SARC(513),SRC0(513),LPM,DE
COMMON BETAV(513),BETA4(513),IJ,LPK,XII(200),XJJ(200),XZX
COMMON XRJVD,A2AA,B2BB,C2CC
COMMON AAAA,B3BB,C3CC,AB,BB,CB,DB,TGAUS(100),NGAUS(100),NGAUS
NDF = 0 CALLED FROM F11+F.
NDF = 1 CALLED FROM RMINT FOR REAL PART.
NDF = 2 CALLED FROM RMINT FOR IMAG. PART.
NDF = 3 CALLED FROM CAVITY CXNEW AT F(5)
IF (ICPI.EQ.0) GO TO 9
DO 10 I3 = 1,7
10 XST(I3) = XSN(IG)
GO TO 12
9 DO 11 IH = 1,7
11 XST(IH) = YXS(IH)
12 CONTINUE
IF (ITERA.EQ.1) GO TO 222
GO TO 223
222 DO 224 ILK = 1,LPM
224 BETAV(ILK) = SBETA
223 CONTINUE
CSpace = (1.+XST(1))/F_DAT(LPK)
FSpace = CSpace/F_DAT(LPM-LPK)
_LPM3=_PM-3
KBET = -1.+CSpace*F_DAT(LPK-1)
XSI1=1.+CSpace
BE1 = BETAV(2)
AP1 = (XSI1-XST(2))/((XSI1+1.)*(XST(1)-XSI1)*(XSI1-XST(3)))
AP1S = SQRT(AP1)
F3 = BE1*AP1S
X1 = XST(4)*SIN(DE_TA)
Y1 = XST(4)*COS(DE_TA)
YY12 = YY1**2
D_M = XSI1 -XX1
PLM2 = PLM**2
PLM4 = PLM2*YY12
PXSR = PLM/PLM4
PXSI = YY1/PLM4
IF(NDF.EQ.1) F3 = F3+PXSR
IF(NDF.EQ.2) F3 = F3+PXSI
IF(NDF.EQ.3) F3=F3/(XSI1-XCA)
ANSA=0.
DO 1 I = 2,_PM3+2
F1 = F3
SPACE = CSpace
IF (I.GE.2) GO TO 30
XSI2 = -1.+SPACE+F_DAT(I)
XSI3 = XSI2+SPACE
GO TO 31
30 SPACE = FSpace
XSI2 = KBET+SPACE+F_DAT(I-LPK+1)

```

```

XSI3 = XSI2+SPACE
51 BE2 = BETAV(I+1)
BE3 = BETAN(I+2)
AP2 = (XSI2-XST(2))/((XSI2+1.)*(XST(1)-XSI2)*(XSI2-XST(3)))
AP3 = (XSI3-XST(2))/((XSI3+1.)*(XST(1)-XSI3)*(XSI3-XST(3)))
AP2S = SQRT(AP2)
AP3S = SQRT(AP3)
F2 = BE2*AP2S
F3 = BE3*AP3S
HA2 = XSI2-XX1
HA22 = -A2**2
H9 = 4A22+YY12
4CR2 = HA2/40
HC12 = YY1/H9
HA3 = XSI3-XX1
HA32 = HA3**2
HD=HA32+YY12
HC03 = HA3/40
HC13 = YY1/HD
IF (NOF.EQ.1) F2 = F2+4CR2
IF (NOF.EQ.1) F3 = F3+4CR3
IF (NOF.EQ.2) F2 = F2+HC12
IF (NOF.EQ.2) F3 = F3+HC13
IF (NOF.EQ.3) F2 = F2/(XSI2-XCA)
IF (NOF.EQ.3) F3 = F3/(XSI3-XCA)
FSUM = (F1+4.*F2+F3)*SPACE/3.
ANS = ANSA+FSUM
1 CJVTINJE
.SQ1 = SQRT((-1.-XST(2))/(-1.-XST(3)))
SQ2 = SQRT(XST(1)+1.)
SQ3 = SQRT((XST(1)-XST(2))/(XST(1)-XST(3)))
ANT1 = BETAV(1)*2.*SQRT(2*SPACE)*SQ1/SQ2
ANT2 = BETAV(LP4)*2.*SQRT(FSPACE)*SQ3/SQ2
APLA = -1.-XX1
AP_A2 = AP_A2**2
APL3 = XST(1)-XX1
APL32 = APLB**2
IF (NOF.EQ.1) ANT1 = ANT1+APLA/(APLA2+YY12)
IF (NOF.EQ.2) ANT1 = ANT1+YY1/(AP_A2+YY12)
IF (NOF.EQ.1) ANT2 = ANT2+APL3/(APL32+YY12)
IF (NOF.EQ.2) ANT2 = ANT2+YY1/(APL32+YY12)
IF (NOF.EQ.3) ANT1 = ANT1/(-1.-XCA)
IF (NOF.EQ.3) ANT2 = ANT2/(XST(1)-XCA)
ANS = ANSA+ANT1+ANT2
RETURN
END

```

vv

```

SUBROUTINE DFSIM2(ANS2)
DIMENSION X(3),XIT(3),YY(3),XITC(3),EXU(3),FCV3(3),KST(7)
COMMON YCCC,SBETA2
COMMON XITM(200),XITN(200),AVSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LP44,NS2
COMMON AJ(100),ISHARP,VCH3Y,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON FLAPAV,DELTA,DSAP,A1,GA44A
COMMON SBETA,XXM,ICPI,SARCO(513)
COMMON IDJ_,XA,XB,XC,TAVG,E,P,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSV(7),CLE,ERC,YYY,XM,ITERA,SXSIO(7),SXSI0(7),YXS(7)
COMMON PSIZ,LP,SARC(513),SARC(513),LP44,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XRJN1,A2AA,3233,C2CC
COMMON AAA4,B3B3,CCCC,A9,99,CS,DS,TSAJS(100),VSAJS(100),NGAUS
DO 13 IS=1,7
13 KST(15)=YXS(15)
PAI=3.141592653
CCC1=AL3G(1.+XST(6))/((2.+PAI))
UJ2=COS(A_FA1+GAM4A)/COS(XST(5)+GAM4A)/XST(7)
K<<=&_3G(JJ2)
CSPACE=(1.+XST(1))/F_DAT(-P)
MSPACE=0.5*CSPACE
FSPACE=CSPACE/F_DAT(-P-L)
HSPACE=0.5*FSPACE
XBET=-1.+CSPACE+F_DAT(LPK-1)
CDE=COS(DE_TA)
SDS=SIN(DE_TA)
GA=KST(1)-XST(4)*SDS
GB=XST(4)*CDE
>>>CDE/(GA*2+GB**2)
FCV3(3)=DSAP+PPP*XST(1)/(PAI+SQRT(1.+XST(6)))
LPKI=L_P44-L_PK+1
DO 1 IP=1,_PM
I=(IP,E2+1) GO TO 2
4SPACE=MSPACE
SPACE=FSPACE
I=(IP,3T,-P)(I) GO TO 30
X(1)=XST(1)-SPACE+F_DAT(IP-L_P44-I-1)
X(2)=X(1)-HSPACE
X(3)=X(1)-SPACE
GO TO 31
30 4SPACE=4CSPACE
SPACE=CSPACE
X(1)=XBET-SPACE+F_DAT(IP-L_P44-I-1)
X(2)=X(1)-HSPACE
X(3)=X(1)-SPACE
31 FCV3(1)=FCV3(3)
V<=3
I=(IP,E2,-P4) N<=2
DO 3 I=2,NK
I=(IJ,3E+23) GO TO 3
GO TO 7
3 I=(I,E2+2) XIT(2)=XIT4(-P4-[P+1])
I=(I,E2+3) XIT(3)=XITN(L_P44-IP+1)
GO TO 5
7 CNTINJE
YY(I)=X(I)
3 DSIV3 CA_CULATE 31 .
CALL DSIV3(YY(I),XITC(I),IP,I)
XIT(I)=XITC(I)

```

```

IF(IJ.EQ.13) GO TO 6
GO TO 5
5 IF(I.EQ.2) XITN(-34-I+1)=XIT(I)
IF(I.EQ.3) XITN(LPM-I+1)=XIT(I)
5 CONTINUE
EXU(I)=EXP(-XIT(I))
GC=X(I)-XST(4)*SDE
GD=XST(4)*CDE
PXA=GC**2+GD**2
DWDX=DXA**2+(GD**2+CDE**2)/(PXA*PAI)
FCN3(I)=EXU(I)*DWDX/3J2
L=(X(I)+LE-3.) FCN3(I)=-FCN3(I)
8 CONTINUE
9 CHECK IF FCN3(I) IS ALWAYS POSITIVE.
I=(IP,E2-24) GO TO 20
GO TO 21
20 P3Q=CDE/((-1.-XST(4)*SDE)**2+(XST(4)*CDE)**2)
FF3=DGAP*P3Q/PAI
FCN3(3)=FF3
21 SJM=(FCN3(1)+FCN3(2)+4.+FCN3(3))/4SPACE/3.
AVS2=AVS2+SJM
I=(IJ-E3+13) SARC(-34-I+1)=AVS2
GO TO 1
2 SARC(-34)=0.
AVS2=0.
1 CONTINUE
2 XITN(-PM)=G1 AT POINT 3.
3 XINT(I)=G1 AT POINT X=1.
XITV(-34)=CCC1-KK<</PAI
XITV(1)=0.
RETJRN
END

```

**

```

SUBROUTINE DFSI43(Y,XII,IP,I)
DIMENSION XST(7),FA(200)
COMMON YCCC,SBE1A2
COMMON XIF1(200),XIF4(200),XNSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAV,LPMH,NS2
COMMON AJ(100),IGHA13,VC43Y,B3TA4(100),B3TA42(100),B3TA42(100)
COMMON FLAPAN,DELTA,JSAP,ALFA1,GAMMA
COMMON SBETA,ICPI,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSNT(7),C_2,ERC,YYY,ITERA,SXSIO(7),SXSIOD(7),YXS(7)
COMMON PSLZ,L^2,SARC(513),SARC0(513),_P4,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XR3JVD,A2AA,B233,C22C
COMMON AAAA,B3B5,CCCC,A8,B8,C8,D8,T3AUS(100),JGAUS(100),NGAUS
DO 10 INTEGRALS TO BE EVALUATED BEFORE XI IS OBTAINED.
NOTE THAT PREVIOUSLY ONLY ONE SINGULAR INTEGRAL WAS
CALCULATED IN SCASCA3 AND CASCADE.
SEE THE NOTE IF TO 3951 FOR FJJR INTEGRALS, OUT OF WHICH
TWO ARE OF SINGULAR TYPE.
IF(ICPI.EQ.0) GO TO 9
DO 11 ISI=1,7
11 XST(ISI)=XSV(ISI)
GO TO 12
9 DO 13 JTJ=1,7
13 XST(JTJ)=YXS(JTJ)
12 PAI=3.141592653
CCC1=ALOG(1.+XST(6))/(2.+PAI)
C-----FIRS I1-----
IF (ITERA.EQ.1) GO TO 60
GO TO 51
50 CONTINUE
51 IZU = 1+LP4
BETAN(IZU) = SBETA
BETAM(IZU) = SBETA
52 CONTINUE
53 CONTINUE
CSPACE=(1.+ XST(1))/F_DAT(-P<)
HCSPAC=0.5*CSPACE
FSPACE=CSPACE/F_DAT(-P4-P<)
MFSPAC=0.5+FSPACE
XBET=-1.+CSPACE+F_DAT(-P<-1)
AB2=SQRT(XST(1)+1.)
AB3=SQRT((1.+Y)-(XST(1)-Y))
AB6 = SQRT((XST(3)-Y)/(XST(2)-Y))
AB3 = AB3*AB6
IZ2=-P4-I^2+1
IZ3=1
IF(I.EQ.3) IJ3=L_P4-I^2+1
IF(I.EQ.0) IJ3=IP
SEC=BETAN(IJ3)
IF(I.EQ.2) SEC=BETAN(IJ2)
FAA=BIC/A33
_P41=-P4-1
DO 1 IW=2,LPM1
SPACE=CSPACE
IF(IW.GT.LPK) GO TO 45
XSK=-1.+SPACE+F_DAT(IJ-1)
GO TO 46
45 SPACE=FSPACE
XSK=XBET+ SPACE+F_DAT(IJ-LPK)

```

```

46 IF(I.EQ.2) GO TO 6
IF(I.EQ.IJ3) GO TO 1
S=SQRT((1.+XSK)*(XST(1)-XS))
SA1 = SQRT((XST(3)-S)/(XST(2)-XS))
S = S-SA1
FA(IW)=(BETAN(IW)/FS-AA)/(XSK-Y)
1 CONTINUE
IF(I.EQ.2) GO TO 30
XP1=-1.+MCSPAC
XP2=XP1+CSPACE
XP4=XST(1)-4FSPAC
XP3=XP4-FSPACE
FS1=BETAM(1)/ SQRT((1.+XP1)*(XST(1)-XP1))
FS2=BETAM(2)/ SQRT((1.+XP2)*(XST(1)-XP2))
FS3=BETAM(LPM-2)/ SQRT((1.+XP3)*(XST(1)-XP3))
FS4=BETAM(LPM-1)/ SQRT((1.+XP4)*(XST(1)-XP4))
SA1 = SQRT((XST(2)-XP1)/(XST(3)-P1))
SA2 = SQRT((XST(2)-XP2)/(XST(3)-XP2))
SA3=SQRT((XST(2)-XP3)/(XST(3)-XP3))
SA4=SQRT((XST(2)-XP4)/(XST(3)-XP4))
FS1=FS1-SA1
FS2=FS2-SA2
FS3=FS3-SA3
FS4=FS4-SA4
P1=(FS1-FAA)/(XP1-Y)
P2=(FS2-FAA)/(XP2-Y)
P3=(FS3-FAA)/(XP3-Y)
P4=(FS4-FAA)/(XP4-Y)
IF(IU3.EQ.2) GO TO 21
IF(IU3.EQ.1) GO TO 22
IF(IU3.EQ.0) GO TO 31
FA(IU3)=0.5*(FA(IJ3-1)+FA(IJ3+1))
GO TO 30
51 BETO=2.+BETAN(LPK)-BETAN(LP<+1)
XA=XBET-FSPACE
FB=BETO/SQRT((1.+XA)*(XST(1)-X04))
FA = SQRT((XST(2)-XA)/(XST(3)-X04))
FP1=FB+FA+FPO
P1=(FB-FAA)/(X04-Y)
FA(IJ3)=0.5*(FA(IJ3+1)+P1)
GO TO 30
21 FA(IJ3)=(P1+P2)/2.
GO TO 30
22 FA(IU3)=(P3+P4)/2.
52 KI=J0
LPM3=LPM-3
SPACE=CSPACE
DO 15 JA=2,LPM3,2
15 X=XI+(FA(JA)+4.*FA(JA+1)+FA(JA+2))*SPACE/3.
IF(I.EQ.2) GO TO 35
KI3=0.5+4CSPACE*(P1+FA(2))+(FA(LPM-1)+FP4) +0.5+4FSPAC
KI=41.
J=39
LPM=LPM-5
IF(IU3.GE.LPM) KI=201.
IF(IU3.GE.-P4A) KI=199
32Z=(BETAN(1)-BETAN(1))/X(I
32Y=(BETAN(-P4)-BETAN(-P4))/X(I
4Z=FSPACE/KI

```

```

4=4=10SPAC/X<1.
FT3=F01
FJ3=F24
XI4=0.
K11=0.
33 202 1T4=1,<J+2
#T1=FT3
#J1=FJ3
XH2=XST(1)-HFSPAC+HFF+FLDAT(ITM)
XH3=XH2+HFF
XT2=-1.+HCSPAC-HF4+F_DAT(IT4)
KT3=XT2-HFF
BETA2=BETA4(LPM1)+B3Y+F_DAT(IT4)
BETA3=BETA2+B3Y
BETT2=BETA4(1)-B3Z+F_DAT(IT4)
BETT3=BETT2-B0Z
FS2=BETA2/SQRT((1.+X42)*(XST(1)-X42))
FS3=BETA3/SQRT((1.+X43)*(XST(1)-X43))
FV2=BETT2/SQRT((1.+T2)*(XST(1)-XT2))
FV3=BETT3/SQRT((1.+T3)*(XST(1)-XT3))
FS2A = SQRT((XST(2)-XH2)/(XST(3)-XH2))
FS3A = SQRT((XST(2)-X43)/(XST(3)-X43))
FV2A = SQRT((XST(2)-XT2)/(XST(3)-XT2))
FV3A = SQRT((XST(2)-XT3)/(XST(3)-XT3))
FS2 = FS2*FS2A
FS3 = FS3*FS3A
FV2 = FV2+FV2A
FV3 = FV3+FV3A
FJ2=(FS2-FAA)/(XH2-Y)
FJ3=(FS3-FAA)/(XH3-Y)
#T2=(FV2-FAA)/(XT2-Y)
#T3=(FV3-FAA)/(XT3-Y)
X14=XI4+HFF+(F01+FJ2*4.+FJ3)/3.
232 ((1=XI1+4F4*(FT1+FT2+4.+FT3)/3.
XA4=BETAN(LPM)*2.+SQRT(HFF)/(4B2*(XST(1)-Y))
XA4A = SQRT((XST(2)-XST(1))/(XST(3)-XST(1)))
XA4 = XA4*XA4A
XI4=XI4*XA4
KA1=BETA4(1)+2.*SQRT(F4F4)/(4B2*(-1.-Y))
XA1A = SQRT((XST(2)+1.)/(XST(3)+1.))
XA1 = XA1*XA1A
XI1=XI1+XA1
XI=(XI+X123+XI1+XI4)+A33/P41
XI=XI+BEC+ALDB((XST(1)-Y-4FF)/(1.+Y-4FF))/PAI
XI1=-XI
33 T3 36
38 XR1=-1.+0.5*HCSPAC
XR2=XR1+HCSPAC
XR4=XST(1)-0.5*HFSPAC
XR3=XR4-HFF
FT1=0.5*(BETAN(1)+BETA4(1))/ SQRT((1.+XR1)*(XST(1)-KR1))
FT2=0.5*(BETA4(1)+BETA4(2))/ SQRT((1.+XR2)*(XST(1)-KR2))
#T3=0.5*(BETA4(LPM-1)+BETA4(LPM-1))/ SQRT((1.+KR3)*(XST(1)-KR3))
#T4=0.5*(BETA4(LPM-1)+BETAN(LPM))/ SQRT((1.+XR4)*(XST(1)-XR4))
FT1A = SQRT((XST(2)-KR1)/(XST(3)-KR1))
FT2A = SQRT((XST(2)-KR2)/(XST(3)-KR2))
FT3A = SQRT((XST(2)-KR3)/(XST(3)-KR3))
#T4A = SQRT((XST(2)-KR4)/(XST(3)-KR4))
#T1 = #T1+FT1A
#T2 = #T2+FT2A

```

```

FT3 = FT3+FT3A
FT4 = FT4+FT4A
FR1=(FT1-FAA)/(XRF1-Y)
FR2=(FT2-FAA)/(XRF2-Y)
FR3=(FT3-FAA)/(XRF3-Y)
FR4=(FT4-FAA)/(XRF4-Y)
XIP1=0.5+4CSPAC*(FR1+FR2)+0.5+4FS*PAC*(FR3+FR4)
XIP2=0.25+4CSPAC*(FR2+FA(2))+0.25+H*SPAC*(FA(LPM-1)+FR3)
XIP3=XIP1+XIP2
XMI=21.
X4I2=02.
4J=21
42=MU-2
_74A=_74-3
I=(IU2,GE,L_PMA) XMI=101.
IF(IU2,GE,_PMA) X4I2=202.
IF(IU2,GE,L_PMA) MU=101
I=(IJ2,GE,_74) 42=4J-2
BETY=(BETA4(L_P4)-BETA4(L_P4-1))/(4J2
BESS=0.5*(BETAN(L_P4)+BETAN(_74-1))
4SP5=0.5+4SPAC/X4I
FQ3=F74
BETY1=(BETA4(1)-BETAN(1))/X4I2
BESS1=0.5*(BETA4(1)+BETAN(1))
4SP51=0.5+4SPAC/X4I
FQ31=F71
XII=0.
X4=0.
DO 129 IL=1,M2,2
F21=F23
F211=FQ31
X2=(XST(1)-4SP5+FLOAT(MJ-IL)
X3=(2+4SP5
X21=-1.+HSP51+FLOAT(MJ-IL)
X31=X21-4SP51
BETA2=BESS+BETY+FLOAT(IL)
BETA3=BESS+BETY+FLOAT(IL+1)
BETA21=BESS1-BETY1+FLOAT(IL)
BETA31=BETA21-BETY1
FJ21=BETA21/SQRT((1.+X21)*(XST(1)-(21))
FJ31=BETA31/SQRT((1.+X31)*(XST(1)-(31))
FJ21A=SQRT((XST(2)-X21)/(XST(3)-(21))
FJ31A=SQRT((XST(2)-X31)/(XST(3)-(31))
FJ21=FU21+FJ21A
FJ31=FU31+FJ31A
FJ21=(FJ31-FAA)/(X21-Y)
FJ31=(FJ31-FAA)/(X31-Y)
FJ2=BETA2/SQRT((1.+X2)*(XST(1)-X2))
FJ3=BETA3/SQRT((1.+X3)*(XST(1)-X3))
FJ2A=SQRT((XST(2)-X2)/(XST(3)-X2))
FJ3A=SQRT((XST(2)-X3)/(XST(3)-X3))
FU2=FU2+FJ2A
FJ3=FJ3+FJ3A
FJ2=(FJ2-FAA)/(X2-Y)
FJ3=(FJ3-FAA)/(X3-Y)
X11=X11+4SP51*(FQ1+F321+4.+F231)/3.
129 X14=X14+HSP5*(FQ1+4.+F22+F33)/3.
XIA=2.*SQRT(HSP5)*BETAN(_74)/(A32+(XST(1)-Y))
XIAA=SQRT((XST(2)-XST(1))/(XST(3)-XST(1)))
XIA=XIA*XIAA

```

```

 $\{ \{ 4 \cdot X[4] \cdot X[1]$ 
 $X[8]=2.0 \cdot SQR(T(HSP61)+3 \cdot ETAN(1)/(A32+(-1.0-Y))$ 
 $X[34]=SQR((XST(2)+L)/(XST(3)+L))$ 
 $X[9]=X[8] \cdot X[34]$ 
 $X[1]=X[1]+X[3]$ 
 $X[1]=X[1]+X[23]+X[4]+A93/PAI$ 
 $X[1]=X[1]+BEC+ALOG((XST(1)-Y-HSP5)/(1.0+Y-HSP61))/PAI$ 
 $\} \{ I13=1\}$ 
36 CONTINUE
-----I2-----
-----IF Y IS LESS THAN ZERO, THIS IS A
-----REGULAR INTEGRAL, WHILE Y >= 0, THIS IS A
-----SINGULAR INTEGRAL.
BTW THIS IS TREATED AS A SINGULAR INTEGRAL ANYWAY
ISIC=3
XCA=0
CALL IC2(S3+S4,XCA,ISIC)
XXI2=S3
ARG_=(XST(1)-Y)/Y
IF (ARG_<=0.0) ARG_=-ARG_
XXI2=XXI2+A93+ALOG(ARG_)
I12=XXI2
-----I3-----
JSE CHEBYShev-GAUSS QUADRATURE.
AJ(I1) ARE ALREADY CALCULATED IN SUBROUTINE F1INTL
AND PASSED ONTO HERE BY COMMON STATEMENT.
I13=0.
BPC5=(XST(1)+XST(2))+.5
C935=(XST(2)-XST(1))+.5
A31=(BPC5+1.0)/C935
A32=(-BPC5+XST(3))/C935
D0 120 ISJ4=1,NC43Y
HA1=1.0-AJ(I1)
HA2=(AJ(I1)+A31)+(A32-AJ(I1))
SHA2=SQR(HA2)
F313=HA1/SHA2
F3A13=C935*AJ(I1)+BPC5-Y
120 XXI3=XXI3+F313/F3A13
XXI3=XXI3+PAI/NC43Y
JJ22=COS(ALFA1+3A441)/COS(XST(5)+3A443)/XST(7)
A43=CCCI-ALOG(JJ22)/PAI
XXI3=XXI3+A93+MX3
-----I4-----
JSE CHEBYSHEV-GAUSS QUADRATURE FORMULA---
B3ETAV2(I) ARE ALREADY CALCULATED IN
SUBROUTINE F1IVTL AND PASSED ONTO HERE BY
COMMON STATEMENT.
FPC5=(XST(3)+XST(2))+.5
F4C5=(XST(3)-XST(2))+.5
A41=(FPC5+1.0)/F4C5
A42=(FPC5-XST(1))/F4C5
XXI4=0.
D0 130 ISJ4=1,NC43Y
RAX=(B3ETAV2(I1)+PAI)*(1.0-AJ(I1))
R3X=(AJ(I1)+A41)*(AJ(I1)+A42)
SR9X=SQR(R3X)
RCX=RAX/SR9X
RDX=FMC5*AJ(I1)+FPC5-Y
130 XXI4=XXI4+RCX/RDX
XXI4=XXI4+PAI/NC43Y

```

```
XXI4 = -XXI4*AB3/PAL
XXII = XXI1+XXI2+XXI3+XXI4
I4RIT1=2
I4RIT2=30
I4RIT3=60
IF (IJ.EG.19.AND.IP.E2.I4RIT1) WRITE(6,55) XXI1,XXI2,XXI3 ,XXI4,IP
IF (IJ.EG.19.AND.IP.E2.I4RIT2) WRITE(6,55) XXI1,XXI2,XXI3,XXI4,IP
IF (IJ.E2.19.AND.IP.E2.I4RIT3) WRITE (6,55) XXI1,XXI2,XXI3,XXI4,IP
55 FORMAT (1)E,-11,I2,13,I4 DF =(4) ARE---,4(E14.7,2X),2X,
A*IP=,I4)
RETJRN
END
```

//

```

SJBR0J1IVE JFSI15(4VS5)
DIMEN$1CV S2S$(101),32ER(101),ST(7)
COMMON YCCS,S3ETA2
C3440V XIT(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(101),IS1AR2,NC4BY,BBTAV(100),BBTAV2(100),BETAN2(100)
COMMON FLAPAV,DELTA,DSAP,ALFA1,GAMMA
COMMON SSETA4,XX4,ICPI,SARC0(513)
COMMON IDJ_+XA,KB,CVANG,EP,YC,YJ3IGS+KL3IGS,BIGS,S4A_S,DSS
COMMON XSN(7)+CLE,ERC,YY4,XM,ITERA,SXSIO(7),SXSI00(7)+YXS(7)
COMMON PS1Z,LP,SARC(513),SARC0(513),LBH,DE
COMMON BETAV(513)+BETAM(513)+IJ+LPK,XII(200),XJJ(200),XDX
COMMON XRJJVD,A2AA,3233,C2C
COMMON AAAA,B3B3,CCCC,A6,B3,C8,TGAUS(100),TGAJS(100),NGAUS
RAI=3.191592624
THIS SJBR0J1IVE CALLED FROM JCNE.
USE SIMPSOVS RULE.
DO 1 IM0 = 1,7
1 XST(IM0) = YXS(IM0)
CDE = COS(DELTA)
SDE = SIN(DELTA)
2 JS2 SHOULD HAVE A FACTOR OF 4.
3 VS2=-2**4=-2**2
NS21 = NS2+1
VS24 = VS2-1
S2GAP = (XST(3)-XST(2))/VS2
JJ2 = CDS(A_FA1+SA44A)/CDS((XST(5)+SA44A)/XST(7))
DO 2 IS2 = 1+VS21
XS2 = XST(2)+S2GAP*(IS2-1)
XCO = XS2+CDE
XMAS = XS2-XST(4)*SDE
XMAS2 = XMAS**2
ASD = XST(4)*CDE
ASD2 = ASD**2
DDCX = DSAP*X4D/((XMAS2+ASD2)+PAI)
IF (IS2.E2+1) GO TO 3
IF (IS2.E2+VS21) GO TO 4
CALL G2 (XS2,ANSG2,IS2)
3 G2 CALCULATES G2 WITH XSI GIVEN.
EG2 = EXP(-ANSG2)
IF (IJ.E2+0) ANSG2S(IS2)=ANSG2
S2KER(IS2) = EG2*DDCX/JJ2
GO TO 2 .
3 CONTINUE
S2KER(1) = DDCX/SQRT(1.+XST(5))
ANSG2S(IS2)=A_03(SQRT(1.+XST(5))/JJ2)
GO TO 2
4 CONTINUE
S2KER(VS21) = DDCX/JJ2
ANSG2S(IS2)=0.
2 CONTINUE
S2SR(1) = 0.
DO 10 JS2 = 1,NS2A+2
10 S2SR(JS2+2) = S2SR(JS2)
1+(S2KER(JS2)+4.*S2KER(JS2+1)+S2KER(JS2+2))*S2GAP/3.
IJ=(IJ+NE+1) GO TO 41
SARC2(1)=0.
DO 30 ISARC=2,VS2+2
30 S2SR([SARC])=0.5*(S2SR([SARC-1])+S2SR([SARC+1]))
DO 30 ISARC=1,VS21

```

```
3C SARC2(1$ARC)=S2SR(1$ARC)
40 CONTINUE
  AVSS = S2SR(NS21)
  RETJRN
  END
```

```

SUBROUTINE IC2(SR,S4,CA,ISIC)
DIMENSION XST(7)
COMMON YCCC,SBETA2
COMMON XIT1(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAV(100),CAJV(100),BETAB,BETAC,YCCC,NCAJ,LPM4,NS2
COMMON AJ(100),IS4AR2,NCHBY,BBTAN(100),BBTAV2(100),BETAV2(100)
COMMON FLAPAN,DELTAB,JBAP,A_FAI,GA4M
COMMON SBETA,XXM,ICPI,SARC0(513)
COMMON IDJL,XA,XB,XC,TAV3,EP,YR,JBIGS,XLB13S,BIGS,SMAL,S,DSS
COMMON XSV(7),CLE,ERC,YYY,XM,ITERA,SXSTD(7),SYSICO(7),YXS(7)
COMMON PSIZ,L,P,SARC(513),SARC0(513),P4,DE
COMMON BETAV(513),BETAM(513),IJ,LPK,KII(200),JJ(200),KJX
COMMON XRQJVD,A2AA,3233,C2CC
COMMON AAAA,3333,CCCC,A3+33,C3,C9,T3AUS(100),NGAJS(100),NGAJS
DO 1 IPN = 1,7
1 XST(IPN) = YXS(IPN)
XX1 = XST(4)*SIN(DE-TA)
YY1 = XST(4)*COS(DE-TA)
YY12 = YY1**2
ISIC = 0 FOR RMINT
= 1 IN CAVITY IF DE=SL45 FOR F(5) AND IN CAVITY.
2 CALLED FROM F1INTL FOR F(1).
3 FOR L2 DE = (4).
SR=0.
S4=0.
B4=XST(1)**5
B4MC=B4-XST(2)
B4P1=B4+1.
B4MF=B4-XST(3)
B11=B4MC/B4
B12=B4P1/B4
B13=B4MF/B4
IF((ISIC+NE*3) GO TO 20
AP1=(XCA+1.)*(XST(1)-XCA)*(XCA-XST(3))
AP2=XCA-XST(2)
APS=Sqrt(AP1/AP2)
20 CONTINUE
DO 7 ISJM=1,NCHBY
RA=(AJ(ISJM)+B11)*(AJ(ISJM)+1.)
RB=(AJ(ISJM)+B12)*(AJ(ISJM)+B13)
SAB=Sqrt(RA/RB)
SAC=B4*Sqrt(1.-AJ(ISJM)**2)/SAB
XSIP=B4*AJ(ISJM)+B4
XPXP=XSIP-XX1
XPYP2=XPXP**2
RV2=X2*P2*YY12
RDR=XPXP/RV2
R4I=YY1/RV2
IF((ISIC+E2*1) RDR=1./(XSIP-YCA)
IF((ISIC+E2*2) RWR=1.
IF((ISIC+E2*3) Rdr=(1.-SAC/APS)/(XSIP-XCA)
SR=SR+SAB*RWR
7 S4=S4+SAB*Rdr
>4I=5+141392654
SR=SR*PAI/VCHBY
S4=S4+PAI/VCHBY
RETURN
END

```

```

SUBROUTINE F1INTL(YINT,KCTR_)

DIMENSION XST(7)
COMMON YCCC,SBETA2
COMMON XITM(200),IFN(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPM4,VS2
COMMON AJ(100),ISHAR2,NCHBY,33TA(100),BETAV2(100),BETAV(100)
COMMON FLAPAN,DELTAB,DGAP,A_FA1,3A44A
COMMON SBETA,XXM,ICPI,SARC0(513)
COMMON IDJ_,XA,XB,XC,TANG,EP,YC,YR,J3IGS,XLB1GS,BIGS,SMALS,DSS
COMMON XS(7),LE,ERC,YYY,KM,ITERA,SXSIO(7),SXSI00(7),YXS(7)
COMMON PSIZ,LP,SARC(513),SARC(513),LP4,DE
COMMON BETAV(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XJX
COMMON XRJJD,A2A1,B2B3,C2C2
COMMON AAAA,BBBB,CCCC,A8,B8,C8,D8,TGAJS(100),NGAJS(100),NGAUS
SUBROUTINE F1INTL CALCULATES THE INTEGRALS IN F(1)
ISHAR2 = 0 FOR SHARP L.E.FOILS.
ISHAR2 = 1 FOR ROUNDED L.E.FOILS.
IF FOILS HAVE ROUNDED L.E., USE CHEBYSHEV-GAUSS
QUADRATURE
QUADRATURE FORMULA CAN NOT BE USED. SINCE BETA
IS NOT A SMOOTH FUNCTION.
NCHBY = NUMBER OF CHEBYSHEV-GAUSS QUADRATURE CONTROL POINTS.
PAI = 3.141592654
IF(ICPI.EQ.0) GO TO 9
DO 70 IJ = 1,7
70 XST(IJ) = XSN(IJ)
DO 11 IH = 1,7
11 XST(IH) = YXS(IH)
12 COMMON
      5 DN1 = (XST(1)+1.)*.5
      DN2 = (XST(1)-1.)*.5
      A11 = (DN2-XST(2))/DN1
      A12 = (DN2-XST(3))/DN1
      BC5 = (XST(1)+XST(2))*.5
      CMB5=(XST(2)-XST(1))*.5
      A31 = (BC5+1.)/CMB5
      A32 = ((-BC5+XST(3))/CMB5
      FCAS = (XST(3)-XST(2))*.5
      FC15 = (XST(3)+XST(2))*.5
      A41 = (FC15+1.)/FCAS
      A42 = (FC15-XST(1))/FCAS
      SPACE2 = (XST(3)-XST(2))/LPMM
      READ _PMM FOR THE SECOND ARCS.
      IF((KCTR.LT.2) GO TO 100
      IF(IJ.GE.2) GO TO 100
      CSPACE = (1.+XST(1))/FLDAT(_PK)
      FSPACE = CSPACE/FLDAT(_P4-_PK)
      IDM = 1
      XCHK = -1.
      SPACE=CSPACE
      DO 20 ICHBY=1,NCHBY
      VCH=NCHBY-ICHBY+1
      AJ(IC4BY)=CDST((2*VCH-1)*PAI/(2*NCHBY))
      KSI=DN1-AJ(IC4BY)+DN2
      IF((ITERA.EQ.1) GO TO 488
      22 IF(XC4CK.GE.XESI) GO TO 21
      IF(IDM.GE._PK) SPACE = FSPACE
      XCHK = XCHK+SPACE
      IDM = IDM+1

```

```

      30 TO 22
C   IF(SI EXISTS BTd XSI(I04-1) AND XSI(I0M)
21  CONTINUE
    I0MA = I0M-1
    BTAV(ICHBY) = BETAV(I0M)+(BETAV(I04)-BETAV(I0MA))
    X=(XSI-XC4CK)/SPACE
C   BTAV IS USED FOR CHEBYSHEV-GAUSS INSTEAD OF BETAV.
    30 TO 20
43B  BTAV(ICHBY) = SBETA
C   BETAV FOR ITERA.E2.1 IS SPECIFIED IN DFSIM1.
    20 CONTINUE
120 CONTINUE
    IF((CTRL.E2.4) GO TO 4
    IF ((CTRL.E2.3) GO TO 3
    IF ((CTRL.E2.2) GO TO 2
    IF (ISHARP.EQ.1) GO TO 10
    YINT = 0.
    DO 110 ISJM = 1,NCHBY
    ABC = (AJ(ISJM)+A11)/(AJ(ISJM)+A12)
110  YINT = YINT +BTAV((ISJM)*SGRT(ABC))
    YINT = YINT*PAI/NC4BY
    GO TO 1000
10  CONTINUE
C   THIS IS THE CASE OF HANDLING RNDG L. E. .
    NDF = 0
    XCA = 0.
    CALL DFSIM1(YINT,NDF,XCA)
C   XCA IS DUMMY, ONLY USED FOR F(5) INDEXING.
    GO TO 1000
2  CONTINUE
    XCA=0.
C XCA IS DUMMY.
    ISIC=2
    CALL IC2(SR,S4,XCA,ISIC)
    YINT=SR
    GO TO 1000
3  CONTINUE
-----INTEGRAL FOR I3.
C   AJ(N) IS CALCULATED AND STORED
    YINT = 0.
    DO 120 ISJM = 1,NC4BY
    A31 = 1.-AJ(ISJM)
    A32 = (AJ(ISJM)+A31)*(A32-AJ(ISJM))
    S2A32 = SGRT(A32)
    ABC = A31/S2A32
120  YINT = YINT+ABC
    YINT = YINT*PAI/NC4BY
    GO TO 1000
-----INTEGRAL FOR I4
C   SINCE BETAV(N) BTAV FOR AND FFT ARE
C   EXPECTED TO BE ALWAYS SMOOTH, USE GAUSS-
C   CHEBYSHEV QUADRATURE FORMULA.
C   AJ(N) IS ALREADY CALCULATED.
C   IF THIS IS THE FIRST CASE FOR BETAV2,
C   USE A CONSTANT FOR BETAN2.
C   BTAN2 IS USED FOR CHEVY-GAUSS INSTEAD OF BETAN2.
4  CONTINUE
    IF(ITERA.E2.2) GO TO 150
    IF(IJ.E2.2) GO TO 191
C   SBETA2 MUST BE READ FOR THE FIRST RUN.

```

```

      DD 181 IC4BY = 1,NC4BY
130 33T4V2 (IC4BY) = SBET42
  VS21=VS2+1
  DD 195 I0C=1,VS21
135 BETAN2(I0C)=SBETA2
  DD T0 181
150 CONTINUE
  IF((IJ.GE.2) GO TO 131
  I044 = 1
  XCCHK = XST(2)
  DD 170 IC4BY = 1,NC4BY
  X = FCA5*AJ(IC4BY)*FC15
152 IF(XC4CK.GE.X) GO T0 151
  XCCHK = XCCHK + SPACES2
  I044 = I044+1
  DD T0 152
151 CONTINUE
  I0MMA = I044-1
  BETAN2(IC4BY) = BETAN2(I0MMA)
  1+(BETAN2(I044)-BETAN2(I0444))*X-XCCHK)/SPACES2
  ILM=IC4BY
  X = FCA5*AJ(ILM )*FC15
  WRITE(6,250) I_4,33T4V2(I_4),X
250 FORMAT(15X,*I=*,15.2X,*33T4V2=*,E14.7,2X,*X=*,E14.7)
170 CONTINUE
181 CONTINUE
  YINT = 0.
  DD 193 ISJ4 = 1,NC4BY
  A31 = (BETAN2(ISJ4)+PAI)*(1.+AJ(ISJ4))
  A32 = (AJ(ISJ4)+A41)*(AJ(ISJ4)+A42)
  SPAB2 = SART(AB2)
193 YINT = YINT + A31/SPAB2
  YINT = YINT*PAI/NC4BY
1930 CONTINUE
  RETJRV
  END

```

**

```

SJBROUTINE CAVITY (XCC,YCC)
C THIS SUBROUTINE IS CALLED FROM IXFNEW FOR F(5).
C DIMENSION CKEX(100),SKEY(100),ANSI1(100),SRI2(100),SIC3I3(100)
C I4EVSI4V SIC4I4(100),XST(7)
C I4EVSI4V CAVXX(100),CAVYY(100)
COMMON YCCC,SBETA2
COMMON XIT4(200),KITN(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LP4M,NS2
COMMON AJ(100),ISHAR,P,NCABY,BETAV(100),BETAV2(100)
COMMON FLAPAN,DELTA,JSAP,ALFA1,GA44A
COMMON SBETA,XX9,ICPI,SARC00(513)
COMMON IJ_,XA,KB,KC,IAV3,E2,YR,JBIGS,X_BIGS,BIGS,SMALS,DSS
COMMON XSV(7),CLI,ERC,YYY,KM,ITERA,SXSIO(7),SXSI00(7),YXS(7)
COMMON PSIZ,LP,SARC(513),SARC0(513),LP4M,DE
COMMON BETAV(513),BETAV2(513),IJ,LPK,XII(200),KJJ(200),XDX
COMMON XRDJND,A2AA,323B,C2CC
COMMON A444,B333,CCCC,A5,B3,C3,D3,TGAJS(100),VGAJS(100),VGAJS
C XCC IS THE CAVITY END POINT CALCULATED IN SUB. CAVITY.
C DE_ = COS(DELT)
C DEL = SIV(DELT)
PAI = 3.141592654
DO 1 _DA=1,7
1 XST(LDA) = YXS(_DA)
SGM = SGRF(1.+XST(S))
CCCI=ALOG(1.+XST(S))/(2.*PAI)
VCAV=30
VCAV1=NCAV+1
CAVS = (XST(2)-XST(1))/VCAV
LEAVE THE LAST POINT OF XSI = C SINCE THERE IS A
SINGULARITY FOR SINGLE SPIRAL VORTEX MODEL.
DO 2 _M = 1,VCAV1
XCA = XST(1) +CAVS*()
REAL PART OF OMEGA = BETA+ PAI.
IF (KLM.EQ.1) GO TO 3
IF (

```

```

E<2 = (XCA+1.)*(XCA-XST(1))*(XCA-XST(3))
EK3 = SGRT(EK1/EK2)
EF33 = CM35*E<3
I= (IJ.GE.34) GO TO 33
SIC3 = 0.
33 5 ISJM = 1.NCHBY
EJ1=(AJ(ISJ4)+A31)+(A32-AJ(ISUM))
SEJ1 = SQRT(EJ1)
EF3 = (1.-AJ(ISJ4))/SEJ1
EF3A = CM35*AJ(ISJ4)+9.PCS-XCA
5 SIC3 = SIC3*(EF3-EF33*SQRT(1.-AJ(ISJ4)**2))/EF3A
SIC3 = SIC3*PAI/NCHBY
SIC3 = SIC3+AUG((XST(2)-XCA)/(XCA-XST(1)))*E<3
IF(IJ.EG.27) SIC3I3(L_M) = SIC3
33 TO 31
31 SIC3 = SIC3I3(L_M)
31 CONTINUE
-----[C4(XSI)-----.
USE C4EBSYS4EV-GAUSS QUADRATURE FORMULA
IN THE SAME MANNER AS THAT FOR I4 IN
OFSIM3.
IF(IJ.GE.34) GO TO 32
FPC5 = (XST(3)+XST(2))*0.5
FMC5 = (XST(3)-XST(2))*0.5
A41 = (FPC5+1.)/FMC5
A42 = (FPC5-XST(1))/FMC5
SIC4 = 0.
32 ISJM = 1.NCHBY
R4 = (3*TAU2(ISJ4)+2*AI)*(L1.+AJ(ISJ4))
R3 = (AJ(ISJ4)+A41)*(AJ(ISJ4)+A42)
SR5 = SQRT(RB)
RC = R4/SR5
RD = FMC5*AJ(ISUM)+FPC5-XCA
7 SIC4 = SIC3*RC/RD
SIC4 = SIC4*PAI/NCHBY
IF(IJ.EG.27) SIC4I4(L_M) = SIC4
33 TO 33
32 SIC4 = SIC4I4(L_M)
33 CONTINUE
1F (IJ.EG.27.AND.KL4.EQ.2) WRITE(6,55) ANS,SR,SIC3,SIC4,KLM
1F (IJ.EG.27.AND.L_M.EQ.40) WRITE(6,55) ANS,SR,SIC3,SIC4,KLM
1F (IJ.EG.27.AND.KLM.EQ.60) WRITE(6,55) ANS,SR,SIC3,SIC4,KLM
35 FOR4AT (13X,---I1,I2,I3,I4 OF CAVITY ARE---,4(E14.7,2X),2X,
A*(KL4=*,I4)
40(XSI) = 1/EK3 ALREADY CALCULATED.
JJ2 = COSA_F41+G144A)/COS(XST(3)+G144A)/XST(7)
SC = (-ANS/PAI-SR*(CC01-AL03(JJ2)/PAI)*SIC3
1-SIC4/PAI)/EK3
GO TO 25
3 SC = 3*ETA3*PAI
GO TO 25
13 SC=3*ETAC*PAI
3*ETAB AND 3*ETAC BODY ANGLES AT B AND C MUST BE SPECIFIED IN COMMON.
25 CONTINUE
XXS = XCA*CDEL
YYT = XCA*XST(4)*SDS-
YYT2 = YYT**2
XXU = XST(2)*CDEL
XXU2 = XXJ**2
XYB = YYT2*XXJ2

```

```

DJDX = DGAP*XXS/(XY3+AI)
CSC = COS(GC)
SGC = SIN(GC)
CFc = JDx/SCGM
CAEX(1..M) = CSC*CFc
SKEY(1..M) = SGC*CFc
2 CONTINUE
CAVXX(1)=0.
CAVYY(1)=0.
D3 15 ICAV=3,NCAV1=2
CAVXX(ICAV) = CAVXX(ICAV-2)+CAVS*(CX*EX(ICAV-2)+CY*
1CX*(ICAV-1)+CY*EX(ICAV))/3.
15 CAVYY(ICAV) = CAVYY(ICAV-2)
1*CAVS*(SKEY(ICAV-2)+CY*SKEY(ICAV-1)+SKEY(ICAV))/3.
1F(IJ,E2,27) GO TO 100
33 TO 101
100 33 102 ICAV=1,NCAV1=2
CAVX(ICAV)=CAVXX(ICAV)
102 CAVY(ICAV)=CAVYY(ICAV)
XCC=CAVX(NCAV1)
YCC=CAVY(NCAV1)
101 CONTINUE
XCC=CAVXX(NCAV1)
YCC=CAVYY(NCAV1)
REIJRV
END

```

```

SUBROUTINE G2 (XS2,AG2,IS2)
DIMENSION XST(7),XI21S(200),XI22S(200),XI23S(200),XI24S(200)
COMMON YCCC,SBETA2
COMMON XI74(200),X174(200),AVSG2S(200),SARC2(200)
COMMON CA/Y(100),CA/Y(100),BETA3,BETA4C,XCCC,NCA/-P44,VS2
COMMON AJ(100),ISHAR,P,NCHBY,BBTAN(100),BBTAN2(100),BETAV2(100)
COMMON =A24V,DE_TA,3GA2,A1,3A441
COMMON SEETA,XXM,ICPI,SARCO(513)
COMMON IDJL,XA,XB,XC,VANG,E2,YC,YR,JBIGS,XLBIGS,BIGS,S4A_S,DSS
COMMON XS(7),ZL,ERC,YYY,XM,ITERA,SXSI0(7),SXSI0(7),YXS(7)
COMMON PSIZ,L_P,SARC(513),SARC(513),L_P,DE
COMMON BETAN(XR0JYD),BETAM(513),IJ,L_P<,KII(200),JJ(200),KJK
COMMON AAAA,BBBB,CDDD,AB,BC,CD,TG1JS(100),TG1JS(100),VGAUS
THIS SJROUTINE IS CALLED BY DFSI45.
THIS SJROUTINE CALCULATES FUNCTION G2(XS2) #4ICH
INC. JCS IS I21(XS2) TO I24(XS2).
XS2 IS XSI- AG2 IS THE SJ. JFCN OF INTEGRALS.
DO 1 IZP=1,7
1 XST(1,IZP)=YXS(IZP)
PAI = 3.141592654
CCCI=ALOG(1.+XST(6))/(2.+PAI)
I= (IJ.GE.47) GO TO 100
----I21(XSI)----.
THE SAME INTEGRATION AS THAT IN
SJROUTINE CAVITY FOR G2(XSI)
NDF = 3
CALL DFSI41(ANS,NDF,XS2)
XI21 = ANS
IF(IJ.EQ.40) XI21S(IS2) = XI21
----I22(XSI)----.
JSE THE SAME SUBROUTINE I22 AS
JSE IN CAVITY WITH LSIC=1.
ISIC=1
CALL I22(SR,S4,XS2,ISIC)
XI22 = SR
NOTE THAT S4 IS DJMAY VARIABLE.
IF(IJ.EQ.40) XI22S(IS2) = XI22
----I23(XSI)----.
JSE C4E3YC4EV-GAUSS 2JADROTJRS FORMULA
IN EXACTLY SIMILAR MANNER TO THAT IN
DFSI43 FOR I3.
XI23 = 0.
BPC5 = (XST(1)+XST(2))*5
C435 = (XST(2)-XST(1))*5
A31 = (BPC5 + 1.)/C435
A32 = (-BPC5 + XST(3))/C435
DO 2 ISUM = 1,NCHBY
H41 = 1.-AJ(ISJ4)
H42 = (AJ(ISU4) + A31)*(A32-AJ(ISJM))
S4A2 = SQRT(H42)
F3I3 = H41/S4A2
F3AI3 = C435*AJ(ISJ4)+BPC5-XS2
2 XI23=F3I3/F3AI3
XI23 = XI23*PAI/NCHBY
IF (IJ.EQ.40) XI23S(IS2) = XI23
----I24----.
JSE C4E3YC4EV-GAUSS 2JADROTJRS
FORMULA BY ASSUMING THAT
THE KERNEL Fcn. IS SMOOTH.

```

```

4J = (XS2+1.)*(XS2-(XST(1))+(XST(3)-S2)
HV = XS2-XST(2)
Hd = SQRT(4J/HV)
FPC5 = (XST(3)+XST(2))+.5
=4C5 = (XST(3)-XST(2))-5
A41 = (FPC5+1.)/=4C5
A42 = (FPC5-XST(1))/=4C5
XI24 = J.
DO 10 ISUM = 1, NCH3Y
TPA1 = AJ(ISUM)*A41
TPA2 = AJ(ISUM)*A42
STP = SQRT(TPA1*TPA2)
F4T = (BBFAV2(ISJ4)*2*AI)*(1.+AJ(ISJ4))/STP
C BETAN2 IS CHEBY-GAJS VERSION FOR BETA ON THE SECOND ARC.
=4A = FMC5*AJ(ISJ4)*FPC5-KS2
ST2 = SQRT(1.-AJ(ISJ4))*2
F49 = FMC5*ST2*(3ETAV2(IS2)+PAI)/4d
10 XI24 = XI24+(F4T-F49)/F4A
XI241 = XI24*PAI/VC4B
3ETAV2 IS JSED FOR SJ4PSDN1S RJ_E.
XLG = AL03((XST(3)-XS2)/(XS2-XST(2)))
IS2 IS TRANSFERRED FROM JG4 32-ARGUMENT.
XI242 = XLG*(BETAN2(IS2)+PAI)/HV
XI24 = XI241+XI242
IF(IJ.EQ.40) XI24S(IS2) = XI24
GO TO 101
101 XI21 = XI21S(IS2)
XI22 = XI22S(IS2)
XI23 = XI23S(IS2)
XI24 = XI24S(IS2)
111 XS2A = -XI21/PAI-XI22
XS2B = CCC1-AL03(CDS(4,FA1+SA44A)/CJS(XST(5)+SA44A)/XST(7))/PAI
XS2C = XS2B*XI23
XS2D = -XI23/PAI
AG2 = (XS2A+XS2C+XS2D)*HV
1= (IJ.EQ.27.AND.IS2.EQ.2) WRITE(5,52) XI21,XI22,XI23,XI24,IS2
1= (IJ.EQ.27.AND.IS2.EQ.10) WRITE(5,52) XI21,XI22,XI23,XI24,IS2
1= (IJ.EQ.27.AND.IS2.EQ.30) WRITE(5,52) XI21,XI22,XI23,XI24,IS2
52 FOR4AT(10,----1,I1,I2,I3,I4) DF F(5) ARE----,4(I14.7,2K),2K,
A *IS2=*,I4)
RETJRV
END

```

```

SUBROUTINE RHENT (SR,SM,M1Q)
DIMENSION XST(7)
C0440V YCCC,SBETA2
COMMON XIT1(200),XITV(200),AVSG2S(200),SARC2(200)
C0440V CAVX(100),CAVY(100),BETAB3,BETAC,XCCC,NCAV,LPMH,NS2
C0440V AJ(100),ISHARP,NCHBY,BBTAV(100),BBTAV2(100),BETAV2(100)
C0440V FLAPAN,DELTA,DGAP,ALFA1,GAMMA
C0440V SBETA4,ICPI,SARCOJ(513)
COMMON IDJL,XA+XB+XC,TANG,EP,YC,YR,JBIGS,XL3I3S,BIGS,SMALS,DSS
C0440V XS(7), C_E,ERC,YYY,KM,ITERA,SXSID(7),SXSIDD(7),YXS(7)
C0440V PSIZ,LP,SARC(513),SARCO(513),LPM,DE
C0440V BETAV(513)+BETAM(513),IJ,L3<,XII(200),XJJ(200),XJX
COMMON ARJJV0,A2AA,3233,C223
COMMON AAA,B325,CCC,A8,B3,B8,TGAUS(100),NGAUS(100),NGAUS
P45 = 3.141592654
IF (ICPI,EQ.0) GO TO 10
DO 12 I5 = 1,7
 12 XST(I5) = XSV(I5)
  GO TO 11
 10 DO 1 IS = 1,7
  1 XST(IS) = YXS(IS)
 11 CONTINUE
    XX1 = XST(4)*SIN(DE_T4)
    YY1 = XST(4)*COS(DE_T4)
    YY12 = YY1**2
    CB5 = (XST(2)-XST(1))*.5
    CC5 = (XST(1)+XST(2))*.5
    A31 = (CC5+1.)/CB5
    A32 = (-CB5*XST(3))/CC5
    BM15 = (XST(1)-1.)*.5
    BP15 = (XST(1)+1.)*.5
    A11 = (BM15-XST(2))/3*15
    A12 = (BM15-XST(3))/3*15
    FPC5 = (XST(3)+XST(2))*.5
    FMCS = (XST(3)-XST(2))*.5
    A41 = (FPC5+1.)/FMCS
    A42 = (FPC5-XST(1))/FMCS
    IF (M1Q.EQ.4) GO TO 3
    IF (M1Q.EQ.3) GO TO 3
    IF (M1Q.EQ.2) GO TO 2
    AJ(1) ARE ALREADY CALCULATED IN SUBROUTINE
    TFINT_1 AND STORED IN COMMON AREA.
    SR=J.
    SM=0.
    DO 20 ISU4 = 1,NCHBY
      Gx1 = 1.-AJ(ISU4)
      GY1 = (AJ(ISU4)+A31)*(A32-AJ(ISU4))
      SGY1 = SART(GY1)
      FF3 = Gx1/SGY1
      FX1 = CC5*AJ(ISU4)+CB5
      FX2 = FX1-XX1
      FX22=FX2**2
      FX3 = FX22*YY12
      FF31 = FX2/FX3
      FF32 = YY1/FX3
      SR = SR+FF3*FF31
  20  S4 = S4+FF3*FF32
      SR = SR+PA1/NCHBY
      S4 = S4+PA1/NCHBY
      GO TO 1000

```

```

2 CONTINUE
1= (ISHARP,EQ=1) GO TO 100
ISHARP = 1 MEANS THAT THE FOIL HAS ROUNDED L.E.
SO THAT THE SIMPS0N'S RULE IS USED.
ISHARP = 0 MEANS THAT THE FOIL HAS SHARP L.E.
SO THAT CHEBYSHEV GAUSS FORMULA CAN BE USED AS BELOW.
SR = 0
S4 = 0
DO 30 ISUM = 1,NC4BY
ST11 = AJ(ISUM)*A11
ST12 = AJ(ISUM)*A12
F<1 = BBTAU(ISUM)*SQR(ST11/ST12)
UN1 = BP15*AJ(ISUM)*3415-XX1
JV12 = JV1**2
JV13 = UN12+YY12
E<11 = JV1/JV13
E<12 = YY1/UN13
SR = SR+F<1*F<11
30 S4 = S4+F<1*F<12
SR = SR+PAI/NCHBY
S4 = S4+PAI/NC4BY
GO TO 1000
100 CONTINUE
C THIS IS THE CASE THAT THE FOIL HAS ROUNDED L.E.
NDF = 1
XCA = 0.
CALL DFSIM1(SR,NDF,XCA)
C XA IS DRAFTY----ONLY USED FOR F(5) IN DFNEW.
NDF=2
CALL DFSIM1(S4,NDF,XA)
GO TO 1000
3 CONTINUE
C USE CHEBYSHEV-GAUSS FORMULA SINCE BETA
IV THIS REGION IS SIMPLY.
BBTAU2 (ISJ4) ARE ALREADY CALCULATED AT TFINT_9.
SR = 0.
S4 = 0.
DO 30 ISUM = 1,NC4BY
PSL = (BBTAU2(ISUM)+PAI)*(1.+AJ(ISUM))
PSM = (AJ(ISUM)+A41)*(AJ(ISJ4)+A42)
SGPSM = SQR(PSM)
FF4 = PSL/SGPSM
PSN = FMC5*AJ(ISUM)+FF45-XX1
PSN2 = PSN**2
FF41 = PSN/(PSN2+YY12)
FF42 = YY1/(PSN2+YY12)
SR = SR+FF4*FF41
SM = SM+FF4*FF42
30 CONTINUE
SR = SR+PAI/NCHBY
S4 = S4+PAI/NC4BY
GO TO 1000
4 CONTINUE
C XCA IS DRAFTY, ONLY USED FOR IC2 IN F(5)
XCA = 0.
ISIC = 0
C SJROUTINE IC2 IS ALSO USED IN F(5).
CALL IC2(S1,S4,XCA,ISIC)
1000 RETURN
END

```

```

SUBROUTINE SHAPE(X,Y,BETA,IS1I2)
COMMON/FREECAV/XFREEC,YFREEC
COMMON/JPER/A2AAJ,323B,2CCJ,AAAAJ,B6BBJ,CCCCJ,A8J,38J,C8J,J8J
COMMON/YCCC,S3ETA2
COMMON/XIT4(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON/CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LP4M,NS2
COMMON/AU(100),I>IAZ,NC4BY,BBTAN(100),BBTAY2(100),BETA42(100)
COMMON/FLAPAN/DELT4,3AP,A_FA1,GA441
COMMON/SBETA,X4,ICPI,SARC0(513)
COMMON/IDJ,XA,XB,XC,TAVG,E9,YC,YR,J8165,XLBIGS,BIGS,S4AL,S,DSS
COMMON/XSV(7),CLE,ERC,YYY,XM,ITERA,SXSIG(7),SXSI00(7),YXS(7)
COMMON/PSIZALP,SARC(513),SARC0(513),LPM,DE
COMMON/BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON/XRJJD,A2AA,323B,2CC
COMMON/AAA,B389,CCCC,A8,B3,B3,38,T3AJS(100),GAUS(100),NGAUS
PAI=3.141592653
X2=XX**2
X3=XX**3
XS=S3RT(X)
X4=X*X
XFREE2=XFREEC**2
XFREE3=XFREEC**3
XFREE4=XFREEC*XFREE3
X22=2**2
X23=2**3
X2S=S3RT(.2)
X2H=.2**X2S
X32=.3**2
X53=.8**3
X5S=S3RT(.8)
X8M=X8S*.8

```

C WE JUST CHECK TO SEE IF WE ARE GOING TO CALCULATE THE TOP PART
C OR THE BOTTOM PART. IF TOP WE TRANSFER TO 2ND HALF OF ROUTINE.
C IS1I2 = 3 IS USED FOR CALCULATIONS OF JPER FOI PROFILE

```

IF((IS1I2.EQ.1) GO TO 30
IF((IS1I2.EQ.3) GO TO 30

IF (X.LE..2) GO TO 15
IF (X.LE..3) GO TO 20
IF (X.GT..3) GO TO 25

15 Y=A2AA*X+323B*X2+2CC*X3
Y0X=A2AA+323B*2.+Y+2CC*3.*X2
BETA=ATAN(Y0X)
GO TO 50
20 Y=AAAA*(4./3.*X+8./3.*XH-4.*X2)+B389*X+CCCC*XS
Y0X=AAAA*(4./3.*X+8./3.*1.5*XS-3.*X)+3389*.5*CCCC/XS
BETA=ATAN(Y0X)
GO TO 50
25 Y=A8+38*X+C8*X2+D8*X3
Y0X=B8+2.*C8*X+3.*D8*X2
BETA=ATAN(Y0X)
GO TO 50

```

C THIS 2ND HALF OF THE ROUTINE IS FOR CALCULATING THE UPPER HALF

```

30 IF ((IS1I2.EQ.3) GO TO 70

```

```

1 IF (XFREEE0-E..2) GO TO 35
1 IF (XFREEE0-E..3) GO TO 50
1 IF (XFREEE0-GT..8) GO TO 55
70 CONTINUE
1 IF (X>LE..2) GO TO 35
1 IF (X>LE..3) GO TO 30
1 IF (X>GT..3) GO TO 55

55 IF (IS1I2.EQ.3) GO TO 50
R1=YFREEC-A2AAU*XFREEE=3232J*XFREE2-C2CCU*XFREE3
GO TO 91
30 R1=0.
31 CONTINUE
1 IF (X>GT..2) GO TO 40
Y=A2AAJ*X+3233J*X2+C2CCU*X3+R1
Y0J=A2AAJ*2.+3233J*(+3.+C2CCJ*X2
BETA=ATAN(Y0X)-PAI
GO TO 50
40 Y2=A2AAU*.2+5288U*X22+C2CCU*X23+R1
R2=Y2-AAA AJ*(4./3.*+2+6./3.*X24-4.*X22)-8333J*.2-C2CCJ*X2S
IF (IS1I2.EQ.3) R2=J.
1 IF (X>GT..3) GO TO 45
Y=AAA AJ*(4./3.*X+5./3.*X4-4.*X2)+8333J*X+C2CCJ*(S+R2
Y0X=AAA AU*(4./3.*X+8./3.*1.5*X5-6.*X)+8888U+.5*C2CCJ/XS
BETA=ATAN(Y0X)-PAI
GO TO 50
45 Y3=A8J+B8J*.8+C8J*X82+D8J*X83+R2
R3=Y3-A8U-B8U*.8-C8J*X82-D8J*X83
1 IF (IS1I2.EQ.3) R3=J.
46 Y=A8J+B8J*(+C8J*X2+D8J*X3+R3
YCx=B8J*2.+C8U*X3+D8U*X2
BETA=ATAN(Y0X)-PAI
GO TO 50
50 IF (IS1I2.EQ.3) GO TO 90
R2=YFREEC-AAA AU*(4./3.*XFREEC+8./3.*XFREEH-4.*XFREEE)-8338U*XFREEC
1 -C2CCJ*XFREEE
GO TO 91
90 R2=0.
31 CONTINUE
1 IF (X>GT..8) GO TO 45
Y=AAA AJ*(4./3.*X+3./5.*XH-4.*X2)+8333J*X+C2CCJ*X+S+R2
Y0X=AAA AU*(4./3.*X+3./3.*1.5*X5-8.*X)+8888U+.5*C2CCJ/S
BETA=ATAN(Y0X)-PAI
GO TO 50
55 IF (IS1I2.EQ.3) GO TO 100
R3=YFREEC-A8U-B8J*XFREEC-C8J*XFREE2-D8U*XFREE3
GO TO 101
130 R3=0.
131 CONTINUE
GO TO 46

50 RETURN
END

```

**

```

SUBROUTINE XYCY(XC3,YC3,CX,CY)
C9440V/JPPER/A2AAU,B2BBU,C2CCJ,AAAAJ,B8BBJ,CCCCJ,A8J,B8J,C8U,D8U
CX=XK
X<2=X<**2
X<3=X<**3
XS=SQRT(XK)
XH=X<*XKS
IP=0
IF (CX.LE..2) GO TO 3
IF (CX.LE..3) GO TO 4
IF (CX.GT..8) GO TO 5
3 F1=A2AAJ*X<+B2BBJ*X<2+C2CCJ*X<3
F2=A2AAU+2.*B2BBU*X<+3.*C2CCU*XK2
F3=X<-CX
FX=F1+(F3/F2-CY)
D1=F2
D2=(D1+F3*(2.*B2BBJ+6.*C2CCJ*X<))/D1**2
DX=X<-D1*D2
DIV=FX</DX
XK=DX-DIV
IP=IP+1
Z=ABS(DIV/XK)
IF ((Z.LE..000001).OR.(IP.EG.20)) GO TO 6
GO TO 3
4 F1=AAAUA*(4./3.*X<+5./3.*XK4-4.*X<2)+B8BBU*XK+CCCCU*XKS
F2=AAAUA*(4./3.+6./3.*1.5*X<5.-8.*X<)+B8BBJ+CCCCJ*.5/XKS
F3=XK-CX
FX=F1+(F3/F2-CY)
D1=F2
D2=(D1-F3*(AAA AJ*(8./3.*1.5*.5/XKS-5.))-CCCCJ*.5*.5/XKH)/D1**2
DX=X<-D2
DIV=FXK/DX
IP=IP+1
Z=ABS(DIV/XK)
IF ((Z.LE..000001).OR.(IP.EG.20)) GO TO 6
GO TO 4
5 F1=A8J+B8J*XK+C8U*X<2+D8U*X<3
F2=B8J+2.*C8U*X<+3.*D8J*X<2
F3=XK-CX
FX=F1+(F3/F2-CY)
D1=F2
D2=(D1-F3*(2.*C8U+6.*D8U*X<))/D1**2
DX=X<-D2
DIV=FXK/DX
XK=X<-DIV
IP=IP+1
Z=ABS(DIV/XK)
IF ((Z.LE..000001).OR.(IP.EG.20)) GO TO 6
GO TO 5
6 XCB=X<
IF (CX.LE..2) YCB=A2AAU*XK+B2BBJ*XK2+C2CCU*XK3
IF (CX.LE..8) YCB=AAA AJ*(4./3.*X<+5./3.*XKH-4.*X<2)+B8BBJ*XK
X+CCCCU*XKS
IF (CX.GT..8) YCB=A8J+B8J*X<+C8J*X<2+D8J*X<3
RETURN
END

```

```
SUBROUTINE ARCS2(S2,XC,YC)
COMMON/XFILEN/XXDD,YYDD
COMMON/UPPER/A2AAU+323BU+C2CCJ,AAAAJ+888BU,CCCCJ+A8U,B8U,C8U,D8U
3  XXDD IS THE ENDPOINT OF THE UPPER FILE OFFSET
XXDD=XXDD
XHIGH=0.
LJD=0.
XINCRJ=(XXDD-XC)/50.
IF (XINCRJ.LE.0.) XINCRJ=-XINCRJ
IS1I2=1
S2=0.
DO 24 IINC=1,50
XLDD=XHIGH
XHIGH=LJD+XINCRJ
CALL ARCLIN(S,XLD,XHIGH,IS1I2)
24 S2=S2+S
RETJRN
END
```

```

SUBROUTINE ARCLEN(XSS,XL,XH,IS1I2)
COMMON YCCC,SBEIA2
COMMON XIT4(200),XITY(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XC2C,NCAV,LPMN,NS2
COMMON AJ(130),IS1AR2,VCHBY,BBTAN(130),BBTAV2(100),BETAV2(100)
COMMON FLAPAN,DELTA,D3AP,AL=AI,GAMMA
COMMON S3ETA,XX4,ICPI,SARC00(513)
COMMON IDUL,XA,XB,XC,TANG,E2,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(7),CL,E,ERC,YYY,XM,ITERA,SXS1D(7),SXSI0D(7),YXS(7)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAV(513),BEIAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XRDJVJ,A2AA,3233,C2CC
COMMON AAAA,B3B3,C0CC,A8,B9,C9,D8,TGAUS(100),JGAUS(100),NGAUS
DIMENSION T(100),d(100),f(100)
V=NGAUS
DO 5 J=1,N
T(J)=TGAUS(J)
5 SJ4=0.
DO 2 J=1,N
CALL FC2(T(J),F(J),X_,XH,IS1I2)
2 SJM=SJM+U(J)*F(J)
XSS=SJM
RETJRN
END

```

**

```

SUBROUTINE FC2(T,F,XH,IS112)
COMMON/UPPER/A2AAU,3233J,C21CJ,AAAAAJ,BB3EJ,CCCCJ,A8J,B8J,C8U,D8J
COMMON/YCCC,S3ETA2
COMMON/XLT(200),XIT(200),XSG2S(210),SARC2(200)
COMMON/CAVX(100),CAVY(100),S3ETA3,B3ETAC,XCCC,N3AV,LFMM,NS2
COMMON/AJ(100),IS1ARP,NC43Y,B3TAN(100),B3TAV2(100),BETAV2(100)
COMMON/FLAPAN,DELT A,DSAP,ALFA1,SA4MA
COMMON/S3ETA,x(4,ICP1,SARC0(513))
COMMON/I0J_,XA4X8,XC,TANG,E P,YC,YI,J3IGS,X-BIGS,BIGS,SMALS,DSS
COMMON/XSV(7),C-EERC,YYY,MM,ITERA,SXS10(7),SXSI00(7),YXS(7)
COMMON/P31Z,L P,SARC(513),SARC0(513),LPM,DE
COMMON/BETAV(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XOX
COMMON/XR0JND,A2AA,3233,C233
COMMON/AAAA,B3BB,CCCC,AB+BB,C3,J8,TGAUS(100),TGAUS(100),NGAUS
ICONVF=1
XP=(XH-XL)*T*.5+((H+L_)*.5
SXP=S3RT(XP)
P2=X^2**2
IF((XP>E..5)) GO TO 1
IF((XP..E..2.AND.IICONVF.E1.1)) GO TO 4
IF((XP.LE..2)) GO TO 3
P1=(4./3.+4.*SXP**4.*XP)*AAAAJ
P2=3333
P3=.5*CCCC/SXP
IF((IS112.E1.1)) P1=(4./3.+4.*SXP**4.*XP)*AAAAJ
IF((IS112.E2.1)) P2=3333U
IF((IS112.E3.1)) P3=.5*CCCCJ/SXP
GO TO 2
3 P1=-.5*SQRT(2.*XR0JND)/SXP+A2AA
P2=3233*SXP**1.5
P3=2.*C2CC*X P
IF((IS112.E2.1)) P1=-.5*S3RT(2.*XR0JND)/SXP+A2AAJ
IF((IS112.E3.1)) P2=3233U*SXP**1.5
IF((IS112.E3.1)) P3=2.*C2CCJ*X P
GO TO 2
4 ICONFIVJE
P1=A2AA
P2=2.*.5233*X P
P3=3.*C2CC*X P2
IF((IS112.E2.1)) P1=A2AAU
IF((IS112.E3.1)) P2=2.*.5233J*X P
IF((IS112.E3.1)) P3=3.*C2CCJ*X P2
GO TO 2
1 P1=33
P2=2.*C8*XP
P3=3.*C8*X P2
IF((IS112.E2.1)) P1=33J
IF((IS112.E2.1)) P2=2.*C8J*X P
IF((IS112.E2.1)) P3=3.*C8U*X P2
2 P4=P1+P2**3
P42=P4**2
P5=1.*P42
S5=S3RT(P5)
F=(XH-XL)*S5*.5
RETJRN
END

```

```

SUBROUTINE MOSEC(A,B,ER1,ER2,X,J,XLP,A,IS1I2)
J=0
X1=A
X2=B
* J=J+1
IF(J>3E-900) GO TO 3
CALL FARC(P=X1,XLP,A,(1,IS1I2))
CALL FARC(P=X2,XLP,A,(2,IS1I2))
X3=X1+(X2-X1)*PFX1/(PFX1-PFX2)
CALL FARC(P=X3,XLP,A,(3,IS1I2))
I=(PFX3)1,2,3
1 X2=X3
X1=X1
I=(A-B)10,10+11
10 Y=X3-ER1
I=(Y-E-0.) Y=0.
GO TO 12
11 Y=X3-ER1
12 CALL FARC(P=Y,X,-P,A,+rIS1I2)
I=(PFY) 5,2,2
3 X1=X3
X2=X2
I=(A-B) 20,20+21
20 Z=X3-ER1
GO TO 22
21 Z=X3-ER1
22 CALL FARC(P=Z,X,-P,A,Z,IS1I2)
I=(PFZ)2,2,5
5 GO TO 9
2 P2= ABS(P=X3)
I=(P2-ER2) 5,5,4
6 X=X3
GO TO 7
8 WRITE(6,9) J
9 =CHR4AT(1X,24J=,I3)
STOP
7 RETJRN
END

```

```
FUNCTION AIT&EV(XX,YY,X,N)
DIMENSION V((1),YY(1),ZZ(2))
I= (N)1,1,2
1 AIT&EV=YY(1)
RETJRV
2 I= (N+3)*20 N=20
V=N+1
3 DO 3 I=1,4
ZZ(<)=YY(<)
DO 4 I=1,N
DO 4 J=I,V
4 ZZ(J+1)=ZZ(I)+(X-XX(I))*(ZZ(J+1)-ZZ(I))/(XX(J+1)-XX(I))
AIT&EV=ZZ(V+1)
RETJRV
END
```

vv

```

SUBROUTINE DETERM (I,N)
1  DETERM  REVISED 02-28-73
    REAL 4
    DIMENSION A(50,50),SAVEA(50,50)
    IF (N .EQ. 1) GO TO 95
    C = 1.
    NV = N
    DO 9 J = 1,N
    DO 9 I = 1,NV
9     SAVEA(I,J) = A(I,J)
    K = 1
    GO TO 13
12    K = K + 1
13    L = K + 1
    L = K
    GO TO 17
15    L = L + 1
17    IF (ABS(SAVEA(I,K)) .GT. ABS(SAVEA(L,K))) L = I
    IF (L .NE. NV) GO TO 15
    IF (L .EQ. K) GO TO 29
    J = K
    GO TO 23
20    INTERCHANGE
    GO TO 23
22    J = J + 1
23    SAVEA(J) = SAVEA(K,J)
    SAVEA(K,J) = SAVEA(L,J)
    SAVEA(L,J) = SAVEA(J)
    IF (J .NE. NV) GO TO 22
    C = -C
28    I = I + 1
    GO TO 31
30    I = I + 1
31    CONTINUE
    IF (SAVEA(K,K) .EQ. 0.) GO TO 48
    D = SAVEA(I,K) / SAVEA(K,K)
    SAVEA(I,K) = 0.
    J = K + 1
    GO TO 35
35    J = J + 1
36    SAVEA(I,J) = SAVEA(I,J) - D * SAVEA(K,J)
    IF (J .NE. NV) GO TO 35
    IF (I .NE. NV) GO TO 30
    IF ((K .NE. (NV-1)) .GO TO 12
    D = 1.
    DO 43 I = 1,NV
    J = I
    J = J + SAVEA(I,J)
    IF (ABS(D) .LT. 1.E-36) GO TO 48
43    CONTINUE
    D = D * C
    RETURN
45    D = A(1,1)
    RETURN
46    D = 0.
    WRITE (6,51)
51    FORMAT(//5X,TERROR MESSAGE FROM DETERM./)
    1 5X,T MATRIX IS SINGULAR. DETERMINANT SET = 0.0 //)
    RETURN
END

```

02-20-73

```

SJBRQJTINE 369ETAX(,R3ETA,IS1I2)
: THIS GIVES BETAX(X(XSI)).
COMMON YCCC,SBETA2
COMMON XIT4(200),XITV(200),XVS32S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPW4,NS2
COMMON AJ(100),ISHAR,PCHBY,BBTAN(100)+BBTAN2(100)+BETAY2(100)
COMMON FLAP4N,DETA,J3A2,A=41,SA44A
COMMON SBETA,XX4,ICPI,SARCOO(513)
COMMON IDJL,XA,XB,KC,TAN3,E3,Y3,JSIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSN(7),CLE,ERK,YYY,(M,ITERA,SXSID(7),SXSIDC(7),YXS(7)
COMMON PSIZ,L2,SARC(513),SARC(513)+LPW,DE
COMMON BETAN(513),BETAN(513)+IJ,LPK,XII(200),XJJ(200),XDX
COMMON XRDJND,A2AA,B2BB,C2CC
COMMON AAA,BBBB,CCCC,A3+B3,C3+D3,TGAUS(100),TGAJS(100),NGAJS
E1=5.E-3
E2=5.E-3
IF(IS1I2.EQ.1) GO TO 20
1 IS1I2=0 FOR S1.
2   I FOR S2.
3   P4AA=P4M-1
4   S4A=SARC(LP)
IF(LP.EQ.LP) GO TO 10
DSS=SARC(LP)-SARC(LP+1)
XLPA=XX
53 TO 21
20 S4ALS=SARC2(LP)
IF(LP.EQ.1) GO TO 11
54 PA=XX
DSS=SARC2(LP)-SARC2(LP+1)
21 CONTINUE
X1A=XLPA
4 X1B=X1A+.001
CALL FARCFAR,X_PA,(13+IS1I2)
IF(FAR.LT.0.) GO TO 3
X1A=X1B
GO TO 4
3 CALL MDSEC(X1A,X1B,ER1,ER2,XX,JII,X_PA,IS1I2)
GO TO 11
10 XX=0.
GO TO 11
110 XX=XCCC
11 CALL S44PE(XX,Y,R3ETA,IS1I2)
RETJRV
END

```

```

SJ3ROUTINE F&C(FAR,4,_PA,X13+IS112)
COMMON YCCC,SBETA2
COMMON XIT4(200),XITV(200),AVSG2S(210),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LP4M,NS2
COMMON AJ(100),IS4AR,I3HBY,B3TAN(100),B3TAV2(100),B3TAV2(100)
COMMON FLAP4,DELTA,JGAP,ALFA1,GA444
COMMON SBETA,X44,ICP1,SARC0(513)
COMMON IOJ,XA,XB,XC,TANG,E2,YC,YR,JBIWS,XLBIGS,BIGS,SMALS,DSS
COMMON XSS(7),CLE,ERC,YYY,XM,ITERA,SXSIG(7),SXSI00(7),YXS(7)
COMMON PSIZ,LP,SARC(513),SARC0(513),L34,DE
COMMON BETAN(513),BETAM(513),IJ,L34,XII(200),XJJ(200),XDX
COMMON XRJND,A244,B233,C233
COMMON AAAA,B323,C323,A3,B3,C3,D3,TGAJS(100),VGAJS(100),NGAUS
IF(XL_P4,E2,X13) GO TO 1
CALL ARCLEV(XSS,X_P4,X13,IS112)
GO TO 2
1 XSS=0.
2 CONTINUE
F&R=DSS-XSS
RETJRV
END

```

7.0

LISTING OF PCASLDW

```

PROGRAM PCASLDW(INPUT,OUTPUT,TAPES=INPUT,TAPES=OUTPUT,TAPE7,TAPE1)

C
C
C  NONLINEAR PARTIALLY CAVITATING CASCADE CALCULATIONS.
C  5/17/1978 PROGRAMMED BY O. FURUYA.
C----PROGRAM REVISED FOR FIXED CAVITY LENGTH VERSION ON 9/15/78.
C      OPEN WAKE MODEL (8/16/1979)

C THIS MODEL USES TWO STAGE WAKE (10/3/1979)

C
DIMENSION YBE(8),XZ(8),BETANO(513),BETAMO(513),BETA02(100)
DIMENSION SXSI(8),XXX(513),CP(513)
DIMENSION FL(200),FD(200),CP2(101),XXX2(201),FL2(100),FD2(100)
COMMON/FOILEND/XXDD,YYDD
COMMON/UPPER/A2AAU,B2BBU,C2CCU,AAAAJ+EEEBU,CCCCJ,A2U,B2U,C2U+D2U
COMMON/CVTVL/CAVLEV+EIGS2
COMMON/FREECAV/YFREEC,YFREEC
COMMON/DELTAD/DELT(5,5)
COMMON YCCC,SBETA2
COMMON XITK(200),XITV(200),ANSG2S(200),SAPC2(200)
COMMON CAVX(100),CAVY(100),BETAE,BETAC,XCCC,NCAV,LPMN,NS2
COMMON AJ(100),ISHAPP,NCHEY,BETAN(100),BETAN2(100),BETAN3(100)
COMMON FLAPAN,DELTA,DSAP,ALFA1,GAMMA
COMMON SEETA,XXM,ICPI,SARCC(513)
COMMON ICJL,XA*X6,XC,TANG,EP,YC,YR,JEIGS,BIGS,SMALS,ESS
COMMON XSI(E),CLE,ERC,YYY,XM,ITERA,SXSI(E),SXSI2(E)+YXS(E)
COMMON PSIZ,L,P,SARC(513),SAPC(513),LPM,DE
COMMON BETAN(513)+BETAN(513)+IJ,LPK,YII(200),XJJ(200),YCX
COMMON XGROUND,A2AA,B2BB,C2CC
COMMON AAAA,BBEE,CCCC,A6,E6,C6,D6,TGAUS(100)+NGAUS(100),NGAUS
COMMON/SPC/SPACE
COMMON/TAJ1/UTAJ

C BETAN----FOR ARC 1 FOR REGULAR INTEGRAL.
C BBTAN IS FOR INTERPOLATED VERSION OF BETAN .
C BETAN2 FOR EQUALLY SPACED INCREMENT FOR ARC 2.
C BBTAN2 FOR CHEBYSHEV- GAUES VERSION OF BETAN2.
PAI=3.141592653
READ(5,750) UTAL

C IF UTAL=0 LINEAR COMB. OF VEL. FOR THAT OF FIRST WAKE.
C UTAL=1 LINEAR COMB. OF PRESSURE FOR THAT OF FIRST WAKE.
READ(5,750) NGAJS
NGAUS1=NGAJS+1
NVAUS2=NGAUS/2
NGAUS2=NVAUS2
READ(5,560) (TGAUS(I),I=NGAUS2,NGAUS)
READ(5,560) (NGAJS(I),I=NGAUS2,NGAJS)
DO 26 IG=1,NVAUS2
TGAUS(IG)=TGAUS(NGAUS1-IG)
26 NGAUS(IG)=NGAUS(NGAUS1-IG)
WRITE(6,561) (TGAUS(I),I=NGAUS2,NGAUS)
WRITE(6,562) (NGAJS(I),I=NGAUS2,NGAJS)
560 FORMAT(4F20.10)
561 FORMAT(1X,*T(I)=*,1*(F10.6,1X))
READ(5,590) XXM

      569 IDELTA=1,E
569 READ(5,591) (DELT(IDELTA,I),I=1,E)
562 FORMAT(1X,**(I)=*,1*(F10.6,1X))


```

```

C          DDYY,DDAX,FT ) (65,51DAEP
      READ(5,560) R,AAAA+BBB+CCCC
      READ(5,560) AB,BB,CB,DE
      READ(5,560) XRCUND,A2AA,B2BB,C2CC
      READ(5,560) AAAAU,BBBBU,CCCCU
      READ(5,560) ABU,BB,CB,CB
      READ(5,560) A2AAU,B2BBU,C2CCU
      READ(5,795) VCHBY
      READ(5,1321) SBETA,SBETAB2,SF4,BETAB3+BETAC
      READ(5,551) LPMS,LPKS,LPM2,IFLAG,IREAD,ISHARP
      READ(5,201) NITTR,MSTOP,MAXIT,NPK
      READ(5,202) AL,IS,GAMMAS,SCLIS,CAVLE
      READ(5,229) DE,DC,DF
C CAVLEN IS A CAVITY LENGTH SPECIFIED.
C      DD 592 IDELT=1,3
      592 WRITE(e,591) (CELT(IDELT,I),I=1,3)

      WRITE(6,6553)
  553 FORMAT(1H1)
      READ(5,6556) ESPACE
  556 FORMAT(F10.5)
      WRITE(5,6557) ESPACE
  557 FORMAT(1X,/,1X,*ESPACE=*,F5.2,/)
      WRITE(5,5551) BETAE,BETAC
      WRITE(5,5555) R,AAAA+BBB+CCCC
      WRITE(5,5555) AB,BB,CB,DE
      WRITE(5,557) XRCUND,A2AA,B2BB,C2CC
      WRITE(5,523) AAAAU,BBBBU,CCCCU
      WRITE(5,524) ABU,BB,CB,DE
      WRITE(5,525) A2AAU,B2BBU,C2CCU
      WRITE(5,1229) LPKS,LPKS,SBETA,IREAD,VCHBY
      WRITE(5,1224) DE,DC,DF,SF4
      WRITE(5,1521) SBETAB
  523 FORMAT(2X,*AAAAU=*,F10.6,2X,*BBBU=*,F1L.6,2Y,*CCCCU=*,F10.6)
  524 FORMAT(2X,*ABU=*,F17.6,2Y,*BBU=*,F17.6,2X,*CBU=*,F10.6,2X,*DCU=*,1
     F10.6)
  525 FORMAT(2X,*A2AAU=*,F10.6,2Y,*B2BBU=*,F1L.6,2X*C2CCU=*,F10.6)
  526 FORMAT(8F10.6)
  591 FORMAT(1X,*CELT(A,I,J)=*,7(F1L.6,2Y))
  555 FORMAT(2X,*R=*,F5.2,2X,*AAAA=*,F1L.6+2X,*BB=*,F1L.6,2X,*CCCC=*,Y
     F10.6)
  556 FORMAT(2X,*AB=*,F17.6+2X,*BB=*,F10.6,2X,*CB=*,F17.6,2X,*DC=*,F10.
     6)
  557 FORMAT(2X,*XRCUND=*,F10.6,2X,*A2AA=*,F17.6,2X,*B2BB=*,F1L.6+2X,*C
     X2CC=*,F10.6)
  795 FORMAT(8F10.6)
C AAAAU,BBBBU,CCCC ARE CONSTANTS FOR 2-TERM CAMBER, X AND SGPT(X)
C -----CALCULATED FROM ANOTHER PROGRAM CALLED *CAMBER*-----
C AB,BB,CB AND DE ARE COEFFICIENTS FOR POLYNOMIALS FOR X GREATER THAN .6.
C CDD AND CLOCK ARE NO. DJMMYY.
C SF4 IS USED FOR DETERMINING WHETHER TO CALCULATE BETA.
  1321 FORMAT(5E14.7)
C IFLAG=1 NEEDS DATA CARDS FOR SYSI(I). I=1-E. IREAD MAY BE SET TO E.
C IF IFLAG>0 DATA WILL BE READ EITHER FROM
C     DATA CARD, IF IREAD=0
C     TAPE1, IF IREAD=1.
  551 FORMAT(10IE)
  201 FORMAT(4IE)

```

```

252 FORMAT(4E14.7)
C DE,DG,DF ARE THE INCREMENTS FOR DERIVATIVES IN CXFNEW.
C DG=1.E-3 & DF=1.E-5 ARE USED BEFORE.
225 FORMAT(3E14.7)
1229 FORMAT(5X,4HLPFM=,I4,2X,4HLPK=,I4,2X,6HSRPA=,E14.7,5X,6HIFREAD=,I1,
  2X,*NCHBY=*,I3)
5651 FORMAT(20X,*BETAB AND BETAC AS FIRST GUESS=*,F10.5,2X,F10.5)
1324 FORMAT(10X,3HDE=,E14.7,2X,3HDS=,E14.7,3HDF=,E14.7,3Y,4HSF4=,E14.7)
1521 FORMAT(10X,*SBETA2=,E14.7)
  SBETA2=SBETA2*PAI/180.
  BETAB=BETAB*PAI/180.
  BETAC=BETAC*PAI/180.
C   LP14=LPM2=VS2
    LPM2=LPM2
    VS2=LPM2
    LPM4_1=LPM4+1
    *RITE(6,1489) LPM2,ISHARP
1439 FORMAT(10X,*LPM2=*,I3,2X,*ISHARP=*,E14.7)
C ISHARP= FOR SHARP L.E.
C   1 FOR ROUNDED L.E.
  SEETA=SBETA*PAI/180.
  DO 999 IJKL=1,NITER
C FFF4 IS PROVIDED FROM CXFNEW, BUT IF THE LOOP DOES NOT GO THROUGH
C IT, FFF4 OF PRESET VALUE MUST BE USED.
  FFF4=0.
  ALFAID=ALFAIS
  GAMMAD=GAMMAS
  SOLID=SOLIDIS
  IF(NMK.EQ.1) GO TO 240
  IF(NMK.EQ.2) GO TO 241
  SOLID=SOLID+0.1*FLCAT(IJKL-1)
  GO TO 243
241 GAMMAD=GAMMAS+2.*FLDAT(IJKL-1)
  GO TO 243
243 ALFAID=ALFAIS-2.*FLDAT(IJKL-1)
243 CONTINUE
  XM=YYM
  ALFA1=ALFAID*PAI/180.
  DGAP=1./SOLID
  GAMMA=GAMMAD*PAI/180.
  DELTA=ALFA1+GAMMA
  FLAPAN=0.
  *RITE(6,655) ALFAID,GAMMAD,SOLID
696 FORMAT(1X,16HINCIDENCE ANGLE=,E14.7,1X,6HGAMMA=,E14.7,1X,9HSOLIDIT
  XY=,E14.7)
  *RITE(6,653) FLAPAN
553 FORMAT(5X,11HFLAP ANGLE=,E14.7)
  STOLL=2.E-4
  STOLS=5.E-4
  ERC=1.E-2
  CLE=1.E-4
  *RITE(6,511) CAVLEN
511 FORMAT(10X,*CAVITY LENGTH=*,E14.7)
C SPECIFY HYDROFOILS CHARACTERISTICS AND SEP. POINTS.
  XC=0.
  YC=0.
  X3=0.
  XA=1.
  XXDD=1.00000
  YYDD=A5U+B5U+C5U+D8J

```

```

      WRITE(6,502)XA,XB,XC,YC,XXDD,YYDD
502 FORMAT(10X,6HCHORD=,E14.7,2X,17HUPPER SEP. POINT=,E14.7,2X,20HCONN
      X. POINT(XC,YC)=(,E14.7,1H,,E14.7,1H)/* XXDD=*,F10.6,2X,*YYDD=*,F10.6)
      Y F10.6)
C START ITERATIVE PROCEDURE.
C -----BASIC FLOW IS THAT OF FLAT PLATE-----.
C IITERAT IS INDEX FOR NUMBER OF ITERATIONS.
      ITERA=1
      IF(IFLAG.EQ.0) ITERA=2
      BIGS=0.
      XHIGH=0.
      XLOW=0.
      IS1I2=0
      XINCRT=XA/50.
      DO 248 IINC=1,50
      XLOW=XHIGH+XINCRT
      XHIGH=XLOW+XINCRT
      CALL ARCLEN(S,XLOW,XHIGH,IS1I2)
248 BIGS=BIGS+S
C -----FIND BIGS2-----
C      FIRST CALL SHAPE TO FIND A CORRESPONDING TO CAVLEN.
      XCCC=CAVLEN
      X=FREC=CAVLEN
      CALL SHAPE(CAVLEN,Y,BETA,3)
      WRITE(6,2000) Y
2000 FORMAT(5X,*Y=*E14.7)
      YFREC=Y
      YCCC =Y
      CALL ARCS2(BIGS2,CAVLEN,Y)
      WRITE(6,504) BIGS,BIGS2
504 FORMAT(10X,5HBIGS=,E14.7,5X,,3BIGS2=*,E14.7)
C CALCULATION OF THE BLADE TRAILING EDGE THICKNESS.
      CALL SHAPE(1.0,UPEND,BETA,3)
      CALL SHAPE(1.0,DNEND,BETA,0)
      THBL=UPEND-DNEND
      WRITE(6,2001) UPEND, DNEND, THBL
2001 FORMAT(10X,*UPEND AT X=1 -----*,F6.4,3X,*DNEND AT X=1 -----*,F6.4)
      X F6.4,3X,*BLADE THICKNESS AT X=1 -----*,F6.4)
      STOL=1.E-5
      LPM=LPM5
      LPK=LPKS
      LPM1=LPM-1
      LPM3=LPM-3
C ICPI IS USED FOR CONTROLLING PROGRAM; 0 FOR ITER. 1 FOR THE REST.
C FIND XS15,XS1C,XS1F,A+ALFA2 BY JSIVS NEWTON,S METHOD.
C SXSI(1)=XSIE
C SXSI(2)=XSIC
C SXSI(3)=XSIF
C SXSI(4)=A WHICH IS THE COEFFT. OF MAPPING FCN.
C SXSI(5)=ALF2
C SXSI(6)=SIGMA
C SXSI(7)=XSIG (LOWER FIRST WAKE CLOSER POINT)
C SXSI(8)=XSIM (UPPER FIRST WAKE CLOSER POINT)
      IF(IJKL.GE.2) GO TO 530
      IF(IFLAG.EQ.0) GO TO 779
C INITIAL GUESS FOR SXSI(I) IS -----
      READ(5,769) (SXSI(KX),KX=1,8)
      GO TO 160
779 READ(IREAD,620) (SXSI(KX),KX=1,8)
620 FORMAT(8F10.7)

```

```

629 DO 621 IC=1,LPM
621 READ(IREAD,622) SARC(IC),BETAN(IC)
522 FORMAT(2E14.7)
DO 1621 IC=1,LPM1
1621 READ(IREAD,622) SARC2(IC),BETAN2(IC)
IF(IFLAG.EQ.0) GO TO 480
GO TO 481
480 DO 482 IBT=1,LPM1
482 BETAM(IBT)=.5*(BETAV(IBT)+BETAN(IBT+1))
481 CONTINUE
180 ICPI=0
WRITE(6,102) ITERA
102 FORMAT(10X,14H ITERATION NO.=,I2)
DO 850 IRP=1,8
850 SXSI0(IRP)=SXSI(IRP)
IF(ITERA.GE.2) STOL=STOLS
IF(ITERA.EQ.1) STOL=STOL_
CALL OXFNEW(SXSI,STOL_,MAXIT,ITN,DG,DF,FFF4)

530 CONTINUE
DO 537 I01=1,8
XSN(I01)=SXSI(I01)
537 WRITE(6,53a) I01,SXSI(I01)
536 FORMAT(10X,5HSXSI(,I1,2H)=,E14.7)
CSPACE=(1.+SXSI(1))/FLCAT(LPK)
HCSPAC=0.5*CSPACE
FSPACE=CSPACE/FLCAT(_PM-LPK)
HFSPEC=0.5*FSPACE
XBET=-1.+CSPACE*FLCAT(LPK-1)
ICPI=1
C ICPI=0 FOR FINDING SXSI(I), I.E., SXSI(I)=YXS(I)2 ICPI=1 FOR THE REST.
C CALCULATION OF PRESSURE DISTRIBUTION ICPI.
IF(ITERA.EQ.1) GO TO 36
DO 35 IB=1,LPM
35 BETANO(IB)=BETAN(IB)
JJ 37 IB=1,LPM1
37 BETAMO(IB)=BETAM(IB)
DO 355 IB=1,LPM1
355 BETAO2(IB)=BETAN2(IB)
36 CONTINUE
UU2=COS(ALFA1+GAMMA)/COS(SXSI(5)+GAMMA)/ESPACE
                7(ISXS/)AMMAG+)E(ISXS(SOC)/AMMAG+1AFLA(SOC=2UU
UU22=UU2**2
UCU1=SQRT(1.+SXSI(6))
QWU1=UCU1*CAVLEN*UU2*(1.-CAVLEN)
QWU12=QWU1**2
CPW=1.-QWU12
IF(JTAU.EQ.1) CPW=-SXSI(6)*CAVLEN+(1.-UU22)*(1.-CAVLEN)
DO 25 LQ=1,LPM
LPE=L
C FIND CP(XSIP) NEXT.
C---- FOR THE FIRST METTED ARC PORTION S1-----
C CP IS BASED ON U1 AND P1.

```

```

C      LP=1 IS NEAR THE T.E.
C      LP=LPM IS NEAR THE L.E.
C      IF(LP.EQ.1) GO TO 521
C      IF(LP.EQ.LPM) GO TO 52
C      Q2=EXP(XITN(LP))
C XITN(I) IS CALCULATED IN OFSIM2 OF OXFNEW FOR F(4).
C      Q2=Q2**2
C      CP(LP)=1.-UU22*Q2
C      GO TO 522
C      52 CP(LP)=-SXSI(6)
C      GO TO 522
C      521 CP(LP)=CPW
C      522 CONTINUE
C      25 CONTINUE
C
C      EUNITNCC 431
C      .C=MPL(PC
C      )3,021X,PCY,PCX(NEKTI=)1-MPL(PC
C      )3,911X,PCY,PCX(NEKTI=)2-MPL(PC
C          ECAPSF-)1(ISXS=021X
C          ECAPSF*.2-)1(ISXS=911X
C              .C=)4(PCY
C              )3-MPL(PC=)3(PCY
C              )5-MPL(PC=)2(PCY
C              )7-4PL(PC=)1(PCY
C                  )1(ISXS=)4(PCX
C          ECAPSF*.2+)2(FCY=)3(PCX
C          ECAPSF*.2+)1(FCX=)2(PCX
C          ECAPSF*.7-)11(ISXS=)1(PCX
C          431 OT OG )1.GE.ARETI(FI
C
C
C*****MAIN INSERT 1*****
C
C-----CP FOR THE SECOND ARC S2-----
C      NUMBER OF CONTROL POINTS ON S2 IS FIXED
C      IN SUBROUTINE OFSI45, I.E.,
C          HALF OF THE POINT USED FOR BETA
C      ANSG2S IN COMMON = G2.
C      D0 680 NCP = 1,LPMM1
C      IF(NCP.EQ.1) GO TO 681
C      IF (NCP.EQ.LPMM1) GO TO 682
C      Q2 = EXP(ANSG2S(NCP))
C      Q2 = Q2**2
C      CP2(NCP) = 1.-Q2*UU22
C      GO TO 680
C      681 CP2(NCP)=-SXSI(6)
C      GO TO 680
C      682 CP2(NCP)=CPW
C      680 CONTINUE
C
C*****MAIN INSERT 1*****
C
C      AF4=ABS(FFF4)
C      IF(AF4.GE.SF4) GO TO 1135
C      GO TO 1134
C      1135 WRITE($,1136)
C      1136 FORMAT($x,*F(4) IS TOO LARGE TO CALCULATE BETA*)

```

```

STOP
C FIND XXX(XSIP) FIRST.
1134 CONTINUE
IS1S2=0
C-----FIRST BETA FOR ARC 1-----
DO 100 LP=1,LPM
LP=LPM-LLP+1
CALL 38BETA(XYX,BETA,IS1S2)
XXX(LP)=XYX
BETAN(LP)=BETA
IF(LP.EQ.LPM) BETAB=BETA
IF(ITERA.LE.MSTOP1) GO TO 100
WRITE(6,101) LP,SARC(LP),XXX(LP),CP(LP),BETAN(LP)
100 CONTINUE
101 FORMAT(1X,2H=,I3,1X,5HSARC=,E14.7,1X,4HXXX=,E14.7,1X,3HCP=,E14.7,
XIX,6HBETAN=,E14.7)

C
C *****MAIN INSERT 2*****
C
C-----BETA FOR ARC S2-----
C      SARC2 HAS BEEN CALCULATED
C      IN SJROUTINE DFSIMS AND
C      STORED IN COMMON AREA.
IS1S2 = 1
DO 429 LLP=1,LPM
LP=LLP
CALL 38BETA(XYX,BETA,IS1S2)
IF(LP.EQ.1) BETAC=BETA
XXX2(LP) = XYX
BETAN2(LP) = BETA
IF(ITERA.LE.MSTOP1) GO TO 329
WRITE(6,239) LP,SARC2(LP),XXX2(LP),CP2(LP),BETAN2(LP)
239 FORMAT(9X,*I=*,I3,1X,*SARC2=*,E14.7,1X,*XXX2=*,E14.7,1X,*CP2=*,E14.7,1X,*BETAN2=*,E14.7)
329 CONTINUE
429 CONTINUE
C
C *****MAIN INSERT 2*****
C
C *****MAIN INSERT 3 *****
C
C FIND LIFT AND DRAG.
C-----FIRST CL AND CD FOR S1 PART.
USID = SIN(DELTA)
UCOD = COS(DELTA)
UXB = SXSI(4)*UCOD
UXB2 = UXB**2
DO 105 ITK = 1,LPM
IF(ITK.GT.LPK) GO TO 106
XPS = -1.*CSPACE*FLDAT(ITK-1)
GO TO 106
106 XPS = XSET*FSPACE*FLDAT(ITK-LPK)
108 CONTINUE
UXA = XPS-SXSI(4)*USID
JXA2 = UXA**2

```

```

PXXP = UCOD/(UXA2+UXB2)
DwDX = DGAP*PXXP*XPS/PAI
COBET1 = COS(BETAN(ITK))
SIBET1 = SIN(BETAN(ITK))
DS1DX = -EXP(-XITN(ITK))*DWDX/UJ22
C G1 IS CALCULATED AT DFSIM2 AS XITN(I).
C AND STORED IN COMMON.
IF(XPS.LT.0.) DS1DX = -DS1DX
XLPI = DS1DX*CP(ITK)
FL(ITK) = -XLPI*COBET1
FD(ITK) = XLPI*SIBET1
115 CONTINUE
C-----CL AND CD FOR S2 PART.
NS21=NS2+1
NS2A=NS2-1
GAP2 = (SXSI(3)-SXSI(2))/NS2
DO 333 ITK = 1, NS21
XRS2 = SXSI(2)+GAP2*(ITK-1)
UXA = XRS2-SXSI(4)*JSID
UXA2 = UXA**2
PXXP = UCOD/(UXA2+UXB2)
DWDX = DGAP*PXXP*KRS2/PAI
COBET2 = -COS(BETAN2(ITK))
SIBET2 = -SIN(BETAN2(ITK))
DS2DX = EXP(-ANSG2S(ITK))*DWDX/JU22
C G2 IS ALREADY CALCULATED AT DFSIM5 AS
C ANSG2S(I). STORED IN COMMON AREA.
XLPI = DS2DX*CP2(ITK)
FL2(ITK) = -XLPI*COBET2
FD2(ITK) = XLPI*SIBET2
338 CONTINUE
SPACE = CSPACE
CLIFT = CSPACE+F_(2)+0.5*FSPACE*FL(LPM1)
CDRAG = 0.5*CSPACE*FD(2)+0.5*FSPACE*FD(LPM1)
DC 111 IUA = 2*LPM3,2
IF(IUA.GE.LPK) SPACE = FSPACE
CLIFT = CLIFT+SPACE*(FL(IUA)+4.*FL(IUA+1)+FL(IUA+2))/3.
111 CDRAG = CDRAG+SPACE*(FD(IUA)+4.*FD(IUA+1)+FD(IUA+2))/3.
DO 321 IUA = 1,NS2A,2
CLIFT = CLIFT+GAP2*(FL2(IUA)+4.*FL2(IUA+1)+FL2(IUA+2))/3.
321 CDRAG = CDRAG+GAP2*(FD2(IUA)+4.*FD2(IUA+1)+FD2(IUA+2))/3.
C-----ADD THE FORCES ON CAVITY PORTIONS.
C SUBROUTINE XCYC CALCULATES
C THE POINT ON THE UPPER BLADE PORTION CORRESP. TO THE CAVITY END POINT.
CXA=XCCC
CYA=YCCC
CALL XCYC(XCCCB,YCCCB,CXA,CYA)
CLIFT = CLIFT+SXSI(6)*XCCCB
CDRAG = CDRAG-SXSI(6)*YCCCB
C-----ADJUST CDRAG FOR THE BASE PRESSURE PW.
CDRAG=CDRAG-CPW*THBL
C-----XCCC AND YCCC ARE THE END POINTS OF CAVITY, CALCULATED IN
C SUBROUTINE CAVITY
C STORED IN COMMON.
C
C **** MAIN INSERT 3 ****
C
C FIND BINF IN 2-1.

```

```

U2U1=COS(ALFA1+GAMMA)/COS(SXSI(5)+GAMMA)/ESPACE
DCN=CCS(ALFA1+GAMMA)*COS(SXSI(5)+GAMMA)
BINF=0.5*SIN(ALFA1+SXSI(5)+2.*GAMMA)/DOWN
BINF=ATAN1./BINF)
AINF=0.5*PAI-BINF-GAMMA
C CDSTAR AND ALSTAR ARE BASED ON VELOCITY AT UPSTREAM INFINITY IN (X,Y).
CDSTAR=CDRAG
CLSTAR=CLIFT
UINF=0.5*SQRT(1.+U2U1**2+2.*U2U1*COS(ALFA1-SXSI(5)))
FINF=2.*DGAP*SIN(ALFA1-SXSI(5))/(UIVF*COS(SXSI(5)+GAMMA))
CLINF=CLSTAR*CCS(AINF)-CDSTAR*SIN(AINF)
CDINF=CLSTAR*SIN(AINF)+CDSTAR*COS(AINF)
CLINF=CLINF/UINF**2
CDINF=CDINF/UINF**2
WRITE(5,117) CLINF,CDINF
117 FORMAT(1X,34HCLINF OR CDINF=FORCE/1/2RC.UINF **2,5X,6HCLINF=,E14.7,
X1X,6HCDINF=,E14.7)
WRITE(6,118) FINF
118 FORMAT(1X,34HFINF IS OBTAINED FROM MOMENTUM EGN,6HFINF=,E14.7)
WRITE(6,221)
221 FORMAT(1X,4EH---CCLL & CCDD ARE BASED ON U1 IN ALFA1 DIRE.---)
CCLL=CLSTAR*COS(ALFA1)-CDSTAR*SIN(ALFA1)
CCDD=CLSTAR*SIN(ALFA1)+CDSTAR*COS(ALFA1)
ALDD=CCLL/CCDD
WRITE(6,131) CCDD,CCLL,ALDD,J2U1
151 FORMAT(1X,5HCCDD=,E14.7,1X,5HCCLL=,E14.7,1X,4HL/D=,E14.7,1X,
X      SHU2U1=,E14.7)
MSTOP1=MSTOP-1
IF(ITERA.LE.MSTOP1) GO TO 140
C
C*****MAIN INSERT 4 *****
C
C CAVITY SHAPE.
C     ALREADY CALCULATED IN
C     SUBROUTINE CAVITY.
C
C     WRITE(6,287)
237 FORMAT(2X,---CAVITY SHAPE----)
NCAV1=NCAV+1
238 KCAV=1,NCAV1,2
235 WRITE(6,286) CAVX(KCAV),CAVY(KCAV)
236 FORMAT(10X,*X=*,E14.7,10X,*Y=*,E14.7)
C
C*****MAIN INSERT 4 *****
C
140 CCCONTINUE
XCCC=0.
YCCC=0.
WRITE(6,823)
823 FORMAT(//,-----UPPER BODY SHAPE-----)
CG 821 ISHP=1,51
X=.02*(ISHP-1)
CALL SHAPE(X,Y,BETA,3)
821 WRITE(6,822) X,Y
822 FORMAT(5X,*X=*,F10.5,2X,*Y=*,F10.5)
RE=IND 7
WRITE(7,763) (SXSI(<>X),KX=1,8)

```

```

766 FORMAT(8F10.7)
DO 766 IC=1,LPM
766 WRITE(7,767) SARC(IC),BETAN(IC)
767 FORMAT(2E14.7)
DO 1766 IC=1,LPMM1
1766 WRITE(7,767) SARC2(IC),BETAN2(IC)
IF(ITERA.GE.MSTOP) GO TO 999
LPK1=LPK-1
SPACE=CSPACE
HSPACE=HCSPAC
DO 50 IM=1,LPM1
IF(IM.EQ.1) GO TO 51
IF(IM.EQ.LPM1) GO TO 55
IF(IM.EQ.LPK1) GO TO 97
IF(IM.EQ.LPK) GO TO 98
IF(IM.GT.LPK) GO TO 93
XY=-1.*SPACE*FLCAT(IM-1)+HSPACE
XZ(1)=-1.*SPACE*FLOAT(IM-2)
XZ(2)=XZ(1)+SPACE
XZ(3)=XZ(2)+SPACE
XZ(4)=XZ(3)+SPACE
GO TO 99
93 SPACE=FSPACE
HSPACE=HFSPAC
XY=XSET+HSPACE+ SPACE*FLOAT(IM-LPK)
XZ(1)=XSET+SPACE*FLCAT(IM-LPK-1)
XZ(2)=XZ(1)+SPACE
XZ(3)=XZ(2)+SPACE
XZ(4)=XZ(3)+SPACE
99 DO 56 IK=1,4
56 YBE(IK)=BETAN(IM+IK-2)
BETAM(IM)=AITKEN(XZ,YBE,XY,3)
GO TO 151
97 BETAM(LPK1)=0.5*(BETAN(LPK1)+BETAN(LPK))
GO TO 151
98 BETAM(LPK)=0.5*(BETAN(LPK)+BETAN(LPK+1))
GO TO 151
51 BETAM(1)=0.5*(BETAN(1)+BETAN(2))
GO TO 151
55 BETAM(LPM1)=0.5*(BETAN(LPM1)+BETAN(_PM))
151 CONTINUE
50 CONTINUE
IF(ITERA.EQ.1) GO TO 6
DO 41 IE=1,_PM
41 BETAN(IE)=BETAN(IE)*(1.-XXM)+BETA0D(IE)*XXM
DO 42 IFG=1,LPM1
42 BETAM(IFG)=BETAM(IFG)*(1.-XXM)+BETA0D(IFG)*XXM
DO 425 IFG=1,LPMM1
425 BETAN2(IFG) = BETAN2(IFG)*(1.-XXM)+BETA02(IFG)*XXM
DO 852 IRP=1,8
852 SXSI(IRP)=SXSI(IRP)*(1.-XXM)+SXSID(IRP)*XXM
6 ITERA=ITERA+1
IF(ITERA.GT.MSTOP) GO TO 28
GO TO 160
28 WRITE(6,29)
29 FORMAT(5x,26HITERATION WAS TERMINATED.)
999 CONTINUE
STOP
END

```

```

SUBROUTINE JXFVIEW(X,STDL,M,I,DS,DF,FFF4)
DIMENSION F(8),P(50,3),X(8),Q(6+8),XRI(8),XMI(8)
C0440V/DELTAD/DELT(3,3)
C0440V /CJTYL/CAV-EV,BIGS2
COMMON/FREECAV/XFREEC,YFREEC
C0440V YCIC,S3ETA2
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAV,-PM4,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAN(100),BBTAN2(100)+BETAN2(100)
COMMON FLAPAN,DELTAB,JGAP,A_FAI,GAMMA
C0440V SBETA,KK4,ICPI,SARC03(513)
COMMON IDUL,XA+XB+XC,TANG,EP,YC_YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
C0440V XSV(8),C_E,ERC,YYY,XM,ITERA,SXSIO(8),SXSIJ(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAN2(513),IJ,LPK,XII(200),XJJ(200)+XJX
COMMON XR3UND,A2AA,323B,C2CC
COMMON AAAA,B9BB,C0CC,AB,B9,C8,DS,TGAUS(100),NGAUS(100),NGAUS
COMMON/SPC/ESPACE
COMMON/TAU1/UTAU
PAI=3.141592653
I=0
IF(ITERA.EQ.3) GO TO 272
D0 57 IIJ=1+8
57 WRITE(6,65) IIJ,X(IIJ)
58 FOR4AT(IX,24X(:,I1+21)=,E14.7)
272 CONTINUE
SI7=-1.-2.*DE-T(7,1)
55 SI1=2.*DE
SI6=2.*DG
I=(X(7).GT.SI7) X(7)=SI7
I=(X(1).LT.SI1) X(1)=SI1
SI10=((1)+2.*JG
I=(X(2).LT.SI10) X(2)=SI10
SI11=X(2)+2.*DG
I=(X(3).LT.SI11) X(3)=SI11
SI8=X(3)+2.*DELT(8,1)
I=(X(3).LT.SI8) X(3)=SI8
I=(X(4).LT.SI6) X(4)=SI6
SI5=(0.5*PAI-GAMMA)+(1.-0.02)
I=(X(5).LT.0.) GO TO 78
I=(X(5).GT.SI5) X(5)=SI5
GO TO 79
78 I=(ABS(X(5)).GT.SI5) X(5)=-SI5
79 CONTINUE
I=(X(5).LE..001) X(5)=.001
D0 58 IIJ=1+8
58 WRITE(6,66) IIJ,X(IIJ)
IJ=1
-----F(1)-----
D0 20 IK=1,8
20 YXS(IK)=X(IK)
5 CONTINUE
<CTRL = 1
CALL F1INTL(YINT1,<CTRL)
2 SJROUTINE F1INTL CALCULATES THE INTEGRALS IN F(1).
<CTRL = 2
CALL F1INTL_(YINT2,<CTRL)
<CTRL = 3
CALL F1INTL_(YINT3,<CTRL)
<CTRL = 4

```

```

CALL F1INTL (YINT4,KCTRL)
KCTRL=5
CALL F1INTL(YINT5,KCTRL)
KCTRL=5
CALL F1INTL(YINT6,KCTRL)
CCC1=ALOG(1.+YXS(6))/(2.*PAI)
CS1=ALOG(COS(YXS(5)+GAMMA)/COS(ALFA1+GAMMA)*ESPACE)
SSG=SQRT(1.+YXS(6))
J2=COS(ALFA1+GAMMA)/COS(YXS(5)+GAMMA)*ESPACE
U22=U2**2
U22I=1./U22
T#0=SSG*CAVLEN/U2+(1.-CAVLEN)
TAUW#0=ALOG(T#0)
T#1=SQRT(1.-(1.-YXS(5)-U22I)*CAVLEN)
TAUW1=ALOG(T#1)
IF (JTAU#0>0) TAUW=TAUW#0
IF (JTAU#0<1) TAUW=TAUW1
FA = -(YINT1/PAI+YINT2-(CCC1+CS1/PAI)*YINT3
    +YINT4/PAI-YXS(5)+TAJ#*(YINT5-YINT6)/PAI)
IF (IJ.EQ.1) WRITE (6,70) YINT1,YINT2,YINT3,YINT4
70 FORMAT (1DX,---,I1,I2,I3,I4, F=(1) ARE---,4(E14.7,2X))
IF (IJ.EQ.1) F(1) = FA
IF (IJ.EQ.2) GO TO 3
IF (IJ.EQ.3) GO TO 4
IF (IJ.EQ.4) GO TO 320
IF (IJ.EQ.5) GO TO 321
IF (IJ.EQ.6) GO TO 322
IF (IJ.EQ.66) GO TO 3222
IF (IJ.EQ.400) GO TO 400
IF (IJ.EQ.401) GO TO 401
IF (IJ.EQ.402) GO TO 402
IF (IJ.EQ.443) GO TO 443
TY5=TAV(YXS(5)+GAMMA)
DT#DA=-TY5*CAVLEN*SSG/T#0/U2
IF (JTAU#0>1) DT#D4=-CAVLEN*TY5/J22/(T#1**2)
DT#DS=0.5/J2*CAVLEN/SSG/T#0
IF (JTAU#0>1) DT#DS=0.5*CAVLEN/(T#1**2)
P(1,5) = TAV(YXS(5)+GAMMA)*YINT3/PAI-1.+(YINT5-YINT6)/PAI*DT#DA
P(1,6)=-YINT3/(2.*PAI*(1.+YXS(6)))+(YINT5-YINT6)/PAI*DT#DS
IJ = 2
YXS(1) = X(1)+DELT(1,1)
GO TO 5
3 F1P = -FA
IJ = 3
YXS(1) = X(1)-DELT(1,1)
GO TO 5
4 F1Q = -FA
P(1,1) = (F1P-F1Q)/(2.*DELT(1,1))
IJ = 4
YXS(1) = X(1)
YXS(2) = X(2)+DELT(1,2)
GO TO 5
320 F1P = -FA
YXS(2) = X(2)-DELT(1,2)
IJ = 5
GO TO 5
321 F1Q = -FA
P(1,2) = (F1P-F1Q)/(2.*DELT(1,2))
YXS(2) = X(2)
YXS(3) = X(3)+DELT(1,3)

```

```

IJ = 5
GO TO 5
322 F1P = -FA
IJ=56
YXS(3)=X(3)-DELT(1,3)
GO TO 5
3222 F1Q=-FA
YXS(3)=X(3)
P(1,3) = (F1P-F1Q)/(2.*DELT(1,3))
P(1,4) = 0.
IJ=403
ABSX7=ABSC(X(7))
YXS(7)=X(7)+DELT(1,7)*ABSX7
GO TO 5
430 F1P=-FA
IJ=401
YXS(7)=X(7)-DELT(1,7)*ABSX7
GO TO 5
431 F1Q=-FA
P(1,7)=(F1P-F1Q)/(2.*DELT(1,7)*ABSX7)
YXS(7)=X(7)
IJ=402
YXS(8)=X(8)+DELT(1,3)
GO TO 5
432 F1P=-FA
IJ=443
YXS(8)=X(8)-DELT(1,3)
GO TO 5
443 F1Q=-FA
P(1,8)=(F1P-F1Q)/(2.*DELT(1,8))
YXS(8)=X(8)

-----F(2) AND F(3)-----
IJ = 7
350 CONTINUE
XKKX=ALOG(COS(ALFA1+GAMMA)/COS(YXS(5)+GAMMA)/ESPACE)
)7(SKY/AMMA3+)5(SXY(SOC/AMMA3+1AFLA(SOC(GCLA = XKKX
XX1 = YXS(4)*SIN(DETA)
YY1 = YXS(4)*COS(DETA)
YY12=YY1*2
CCC1=ALOG(1.+YXS(6))/(2.*PAI)
CON1 = CCC1-XKKX/PAI
XRR = 0.
XMM = 0.
DO 331 MIQ = 1,6
CALL_RMINT(SOLNR,SOLVM,MIQ)
XRRI(MIQ) = SOLVR
XMMI(MIQ) = SOLNM
XRRR = -XRRI(MIQ)/PAI
XMMM = -XMMI(MIQ)/PAI
IF (MIQ.EQ.1) XRRR = CON1*XRRI(MIQ)
IF (MIQ.EQ.1) XMMM = CON1*XMMI(MIQ)
IF (MIQ.EQ.4) XRRR = -XRRI(MIQ)
IF (MIQ.EQ.4) XMMM = -XMMI(MIQ)
IF (MIQ.EQ.5) XRRI(MIQ)=-XRRI(MIQ)/PAI
IF (MIQ.EQ.5) XMMI(MIQ)=-XMMI(MIQ)/PAI
IF (MIQ.EQ.6) XRRI(MIQ)=XRRI(MIQ)/PAI
IF (MIQ.EQ.6) XMMI(MIQ)=XMMI(MIQ)/PAI
IF ((JTAJ.EQ.0).AND.(MIQ.GE.5))      XRRR=XRRI(MIQ)+TAUJO
IF ((JTAU.EQ.0).AND.(MIQ.GE.5))      XMMM=XMMI(MIQ)+TAUWO
IF ((JTAU.EQ.1).AND.(MIQ.GE.5))      XRRR=XRRI(MIQ)+TAUW1

```

```

IF ((JTAU.EQ.1).AND.(MIQ.GE.5))      XMMH=XMMI(MIQ)*TAUW1
IF (IJ.EQ.7) WRITE (5,71) (XRR(I),I=1,4)
IF (IJ.EQ.7) WRITE (5,72) (XMMI(I),I=1,4)
71 FORMAT(10X,---,XRR(I),I=1,4 OF F(2) AND F(3) ARE----,4(E14.7,2X))
72 FORMAT(10X,---,XMMI(I),I=1,4 OF F(2) AND F(3) ARE----,4(E14.7,2X))
XRR = XRR+XRRR
XMM = XMM+XMMI
331 CONTINUE
-----CALCULATION OF H1(ZETA1)-----
XSIP1 = XX1+1.
XSIM8 = XX1-YXS(1)
XSIMF = XX1-YXS(3)
XSIMC = XX1-YXS(2)
XSIP12 = XSIP1**2
XSIMB2 = XSIMB**2
XSIMF2 = XSIMF**2
XSIMC2 = XSIMC**2
RRA = SQRT(XSIP12+YY12)
RRE = SQRT(XSIMB2+YY12)
RRC = SQRT(XSIMF2+YY12)
RRD = SQRT(XSIMC2+YY12)
THIA = ATAN(YY1/XSIP1)
IF (XSIP1.EQ.0.) THIA = PAI+THIA
THIB = ATAN(YY1/XSIMB)
IF (XSIMB.EQ.0.) THIB = PAI+THIB
THIC = ATAN(YY1/XSIMF)
IF (XSIMF.EQ.0.) THIC = PAI+THIC
THID = ATAN(YY1/XSIMC)
IF (XSIMC.EQ.0.) THID = PAI+THID
RR1 = SQRT(RRA*RRE*RRC/RRD)
THIT1 = .5*(THIA+THIB+THIC-THID)
COTH1 = COS(THIT1)
SIT1 = SIN(THIT1)
F2CO = RR1*(XRR+COTH1-XMM*SIT1)-ALFA1
F3CO = RR1*(XRR+SIT1+XMM*COTH1)+KKKX
IF (IJ.EQ.7) F(2) = -F2CO
IF (IJ.EQ.7) F(3) = -F3CO
IF (IJ.EQ.9) GO TO 340
IF (IJ.EQ.9) GO TO 341
IF (IJ.EQ.10) GO TO 342
IF (IJ.EQ.11) GO TO 343
IF (IJ.EQ.12) GO TO 344
IF (IJ.EQ.13) GO TO 345
IF (IJ.EQ.14) GO TO 346
IF (IJ.EQ.15) GO TO 347
IF (IJ.EQ.403) GO TO 403
IF (IJ.EQ.404) GO TO 404
IF (IJ.EQ.405) GO TO 405
IF (IJ.EQ.406) GO TO 406
TA2G = TAV(YXS(5)+GA44A)
XCXS= XRR(1)*COT41 - XMMI(1)*SIT1
XSXC= XRR(1)*SIT1 + XMMI(1)*COT41
RC1=RR1*COT41
RS1=RR1*SIT1
XR56=XRR(5)+XRR(6)
X456=X44I(5)*X44I(6)
RR56=RC1*XR56-RS1*X456
R456=RC1*X456+RS1*XR56
P(2,5) = -RS1*TA2G*XCS
P(2,5) = P(2,5)/PAI+RR56*DTWDA

```

```

P(3,5) = -RR1*TA2G*XSC
P(3,5) = P(3,5)/PAI+TA2G+RM56*DTWDA
BPY=2.*PAI*(1.+YXS(5))
P(2,6)=RR1*(XRR1(1)+CJTH1-XM4I(1)*SITH1)/BPY+RR56*DTWDS
P(3,6)=RR1*(XRR1(1)+SITH1+XM4I(1)*CJTH1)/BPY+RM56*DTWDS
IJ = 3
YXS(1) = X(1)+DELT(1,2)
GO TO 330
340 FP2 = F2C0
FP3 = F3C0
IJ = 9
YXS(1) = X(1)-DELT(2,1)
GO TO 330
341 P(2,1) = (FP2-F2C0)/(2.*DELT(2,1))
P(3,1) = (FP3-F3C0)/(2.*DELT(2,1))
YXS(1) = X(1)
YXS(2) = X(2)+DELT(2,2)
IJ = 10
GO TO 330
342 FP2 = F2C0
FP3 = F3C0
YXS(2) = X(2)-DELT(2,2)
IJ=11
GO TO 330
343 P(2,2) = (FP2-F2C0)/(2.*DELT(2,2))
P(3,2) = (FP3-F3C0)/(2.*DELT(2,2))
YXS(2) = X(2)
YXS(3) = X(3)+DELT(2,3)
IJ = 12
GO TO 330
344 FP2 = F2C0
FP3 = F3C0
YXS(3) = X(3)-DELT(2,3)
IJ = 13
GO TO 330
345 P(2,3) = (FP2-F2C0)/(2.*DELT(2,3))
P(3,3) = (FP3-F3C0)/(2.*DELT(2,3))
YXS(4) = X(4)+DELT(2,4)
YXS(3)=X(3)
IJ=14
GO TO 330
346 FP2=F2C0
FP3=F3C0
YXS(4) = X(4)-DELT(2,4)
IJ = 15
GO TO 330
347 P(2,4) = (FP2-F2C0)/(2.*DELT(2,4))
P(3,4) = (FP3-F3C0)/(2.*DELT(2,4))
YXS(4)=X(4)
IJ=403
YXS(7)=X(7)+DELT(2,7)*ABSX7
GO TO 330
433 FP2=F2C0
FP3=F3C0
YXS(7)=X(7)-DELT(2,7)*ABSX7
IJ=404
GO TO 330
434 P(2,7)=(FP2-F2C0)/(2.*DELT(2,7)*ABS(7))
P(3,7)=(FP3-F3C0)/(2.*DELT(3,7)*ABS(7))
YXS(7)=X(7)

```

```

IJ=405
YXS(8)=X(8)+DELT(2,8)
GO TO 330
405 F2=F2C0
F3=F3C0
IJ=405
YXS(8)=X(8)-DELT(2,8)
GO TO 330
406 P(2,8)=(F2-F2C0)/(2.*DELT(2,8))
P(3,8)=(F3-F3C0)/(2.*DELT(3,8))
YXS(8)=X(8)
-----F(4)-----
IJ=16
YXS(1)=X(1)+DELT(4,1)
139 CALL OFSIM2(ANS2)
I=(IJ.EQ.16) GO TO 513
I=(IJ.EQ.17) GO TO 514
I=(IJ.EQ.18) GO TO 515
I=(IJ.EQ.19) GO TO 515
I=(IJ.EQ.20) GO TO 515
I=(IJ.EQ.21) GO TO 517
IF(IJ.EQ.22) GO TO 518
I=(IJ.EQ.23) GO TO 521
I=(IJ.EQ.24) GO TO 522
I=(IJ.EQ.25) GO TO 523
I=(IJ.EQ.26) GO TO 524
I=(IJ.EQ.261) GO TO 5241
I=(IJ.EQ.262) GO TO 5242
I=(IJ.EQ.407) GO TO 407
I=(IJ.EQ.408) GO TO 408
I=(IJ.EQ.409) GO TO 409
I=(IJ.EQ.410) GO TO 410
513 ANSP=ANS2
IJ=17
YXS(1)=X(1)-DELT(4,1)
GO TO 199
514 ANS2=ANS2
IJ=18
P(4,1)=-(ANSP-ANS2)/(2.*DELT(4,1))
YXS(1)=X(1)
GO TO 199
515 ANSF=ANS2
F(4)=-(BIGS-ANSF)
IJ=19
YXS(2)=X(2)+DELT(4,2)*ABS(X(2))
GO TO 199
515 ANSP=ANS2
IJ=20
YXS(2)=X(2)-DELT(4,2)*ABS(X(2))
GO TO 199
516 ANS2=ANS2
P(4,2)=-(ANSP-ANS2)/(2.*DELT(4,2)*ABS(X(2)))
YXS(2)=X(2)
IJ=21
YXS(3)=X(3)+DELT(4,3)*X(3)
GO TO 199
517 ANS1P=ANS2
IJ=22
YXS(3)=X(3)-DELT(4,3)*X(3)
GO TO 199

```

```

513 ANS1Q=ANS2
P(4,3)=-(ANS1P-ANS1Q)/(2.*DELT(4,3)*X(3))
YXS(3)=X(3)
IJ=23
YXS(4)=X(4)+DELT(4,4)*ABS(X(4))
GO TO 199
521 ANA=ANS2
IJ=24
YXS(4)=X(4)-DELT(4,4)*ABS(X(4))
GO TO 199
522 ANB=ANS2
P(4,4)=-(ANA-ANB)/(2.*DELT(4,4)*ABS(X(4)))
YXS(4)=X(4)
IJ=25
YXS(5)=X(5)+DELT(4,5)
GO TO 199
523 BNA=ANS2
IJ=26
YXS(5)=X(5)-DELT(4,5)
GO TO 199
524 BNB=ANS2
P(4,5)=-(BNA-BNB)/(2.*DELT(4,5))
YXS(5)=X(5)
FF4=F(4)
YXS(5)=X(5)
YXS(6)=X(6)+DELT(4,6)
IJ=261
GO TO 199
5251 BVA=ANS2
IJ=262
YXS(6)=X(6)-DELT(4,6)
GO TO 199
5252 BNB=ANS2
P(4,6)=-(BVA-BNB)/(2.*DELT(4,6))
YXS(6)=X(6)
IJ=407
YXS(7)=X(7)+DELT(4,7)*ABSX7
GO TO 199
427 ANA=ANS2
YXS(7)=X(7)-DELT(4,7)*ABSX7
IJ=408
GO TO 199
428 ANB=ANS2
P(4,7)=-(ANA-ANB)/(2.*DELT(4,7)*ABSX7)
YXS(7)=X(7)
YXS(5)=X(5)+DELT(4,5)
IJ=409
GO TO 199
429 ANA=ANS2
IJ=410
YXS(8)=X(3)-DELT(4,3)
GO TO 199
430 ANB=ANS2
P(4,8)=-(ANA-ANB)/(2.*DELT(4,8))
YXS(8)=X(9)
-----F(5) AND F(7)-----
C THIS SUBROUTINE FINDS THE END POINT OF CAVITY.
IJ = 27
315 CALL CAVITY (XCEND,YCEND)
IS1I2=3

```

```

CALL SHAPE(XCEND,YUPPER,BETA,IS1I2)
I=(IJ.EQ.27) GO TO 320
IF(IJ.EQ.28) GO TO 921
I=(IJ.EQ.29) GO TO 922
I=(IJ.EQ.30) GO TO 923
I=(IJ.EQ.31) GO TO 924
I=(IJ.EQ.32) GO TO 925
IF(IJ.EQ.33) GO TO 926
I=(IJ.EQ.34) GO TO 927
I=(IJ.EQ.341) GO TO 330
I=(IJ.EQ.35) GO TO 928
I=(IJ.EQ.36) GO TO 929
I=(IJ.EQ.37) GO TO 340
I=(IJ.EQ.38) GO TO 341
IF(IJ.EQ.411) GO TO 411
I=(IJ.EQ.412) GO TO 412
I=(IJ.EQ.413) GO TO 413
IF(IJ.EQ.414) GO TO 414
320 F(5)=-(XCEND-CAVLEV)
F(7) = -(YCEND-YUPPER)
IJ = 29
YXS(1) = X(1)+DELT(5,1)
GO TO 815
321 ANP=XCEND
ANP7=YCEND-YUPPER
IJ = 29
YXS(1) = X(1)-DELT(5,1)
GO TO 815
322 P(5,1)=(ANP-XCEND)/(2.+DELT(5,1))
ANG7=YCEND-YUPPER
P(7,1) = (ANP7-ANG7)/(2.+DELT(5,1))
YXS(1) = X(1)
YXS(2) = X(2)+DELT(5,2)*ABS(X(2))
IJ = 30
GO TO 815
323 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(2) = X(2)-DELT(5,2)*ABS(X(2))
IJ = 31
GO TO 815
324 P(5,2)=(ANP-XCEND)/(2.+DELT(5,2)*ABS(X(2)))
ANG7=YCEND-YUPPER
P(7,2) = (ANP7-ANG7)/(2.+DELT(5,2)*ABS(X(2)))
YXS(2) = X(2)
IJ = 32
YXS(3) = X(3)+DELT(5,3)*X(3)
GO TO 815
325 ANP=XCEND
ANP7=YCEND-YUPPER
YXS(3) = X(3)-DELT(5,3)*X(3)
IJ = 33
GO TO 815
326 P(5,3)=(ANP-XCEND)/(2.+DELT(5,3)*X(3))
ANG7=YCEND-YUPPER
P(7,3) = (ANP7-ANG7)/(2.+DELT(5,3)*X(3))
IJ = 34
YXS(3) = X(3)
YXS(4) = X(4)+DELT(5,4)*ABS(X(4))
GO TO 815
327 ANP=XCEND

```

```

4VP7=YCEND-YJPPER
YXS(4) = X(4)-DELT(5,4)*ABS(X(4))
IJ=341
GO TO 315
330 CONTINUE
P(5,4)=(ANP-XCEND)/(2.+DELT(5,4)*ABS(X(4)))
ANQ7=YCEND-YUPPER
P(7,4) = (AVP7-ANP7)/(2.+DELT(5,4)*ABS(X(4)))
YXS(4) = X(4)
YXS(5) = X(5)+DELT(5,5)
IJ = 35
GO TO 315
325 ANP=XCEND
AVP7=YCEND-YUPPER
YXS(5) = X(5)-DELT(5,5)
IJ = 35
GO TO 315
329 P(5,5)=(ANP-XCEND)/(2.+DELT(5,5))
ANQ7=YCEND-YUPPER
P(7,5) = (AVP7-ANP7)/(2.+DELT(5,5))
YXS(5)=X(5)
YXS(6)=X(6)+DELT(5,6)
IJ=37
GO TO 315
340 ANP=XCEND
AVP7=YCEND-YUPPER
YXS(6)=X(6)-DELT(5,6)
IJ=38
GO TO 315
341 P(5,6)=(ANP-XCEND)/(2.+DELT(5,6))
ANQ7=YCEND-YUPPER
P(7,6) = (AVP7-ANP7)/(2.+DELT(5,6))
YXS(6)=X(6)
IJ=411
YXS(7)=X(7)+DELT(5,7)*ABSX7
GO TO 315
411 ANP=XCEND
AVP7=YCEND-YUPPER
IJ=412
YXS(7)=X(7)-DELT(5,7)*ABSX7
GO TO 315
412 P(5,7)=(ANP-XCEND)/(2.+DELT(5,7)*ABSX7)
ANQ7=YCEND-YUPPER
P(7,7) = (AVP7-ANP7)/(2.+DELT(5,7)*ABSX7)
YXS(7)=X(7)
IJ=413
YXS(8)=X(8)+DELT(5,8)
GO TO 315
413 ANP=XCEND
AVP7=YCEND-YUPPER
IJ=414
YXS(8)=X(8)-DELT(5,8)
GO TO 315
414 P(5,8)=(ANP-XCEND)/(2.+DELT(5,8))
ANQ7=YCEND-YUPPER
P(7,8) = (AVP7-ANP7)/(2.+DELT(5,8))
YXS(8)=X(8)
-----F(5)-----
IJ=40
350 CALL DFSI45(ANS5)

```

```

IF(IJ.EQ.40) GO TO 851
IF(IJ.EQ.41) GO TO 352
IF(IJ.EQ.42) GO TO 353
IF(IJ.EQ.43) GO TO 354
IF(IJ.EQ.44) GO TO 355
IF(IJ.EQ.45) GO TO 356
IF(IJ.EQ.46) GO TO 357
IF(IJ.EQ.47) GO TO 358
IF(IJ.EQ.48) GO TO 359
IF(IJ.EQ.49) GO TO 360
IF(IJ.EQ.50) GO TO 351
IF(IJ.EQ.51) GO TO 352
IF(IJ.EQ.52) GO TO 353
IF(IJ.EQ.415) GO TO 415
IF(IJ.EQ.416) GO TO 416
IF(IJ.EQ.417) GO TO 417
IF(IJ.EQ.418) GO TO 415
351 F(6)=-(ANS5-6IGS2)
IJ=41
YXS(1)=X(1)+DELT(6,1)
GO TO 350
852 ANP=ANS5
IJ=42
YXS(1)=X(1)-DELT(6,1)
GO TO 850
353 P(6,1)=(ANP-ANS5)/(2.+DELT(6,1))
YXS(1)=X(1)
IJ=43
YXS(2)=X(2)+DELT(6,2)
GO TO 850
354 ANP=ANS5
IJ=44
YXS(2)=X(2)-DELT(6,2)
GO TO 850
355 P(6,2)=(ANP-ANS5)/(2.+DELT(6,2))
IJ=45
YXS(2)=X(2)
YXS(3)=X(3)+DELT(6,3)
GO TO 850
356 ANP=ANS5
IJ=46
YXS(3)=X(3)-DELT(6,3)
GO TO 850
357 P(6,3)=(ANP-ANS5)/(2.+DELT(6,3))
IJ=47
YXS(3)=X(3)
YXS(4)=X(4)+DELT(6,4)
GO TO 850
358 ANP=ANS5
IJ=48
YXS(4)=X(4)-DELT(6,4)
GO TO 350
359 P(6,4)=(ANP-ANS5)/(2.+DELT(6,4))
IJ=49
YXS(4)=X(4)
YXS(5)=X(5)+DELT(6,5)
GO TO 850
360 ANP=ANS5
IJ=50
YXS(5)=X(5)-DELT(6,5)

```

```

      30 TO 850
851 P(6,5)=(ANP-ANS5)/(2.*DELT(6,5))
YXS(5)=X(5)
YXS(6)=X(6)+DELT(6,5)
IJ=51
GO TO 850
852 ANP=ANS5
YXS(6)=X(6)-DELT(6,5)
IJ=52
GO TO 850
853 P(6,6)=(ANP-ANS5)/(2.*DELT(6,6))
YXS(6)=X(5)
YXS(7)=X(7)+DELT(6,7)*ABSX7
IJ=415
GO TO 850
415 ANP=ANS5
YXS(7)=X(7)-DELT(6,7)*ABSX7
IJ=415
GO TO 850
416 P(6,7)=(ANP-ANS5)/(2.*DELT(6,7)*ABS(7))
YXS(7)=X(7)
YXS(8)=X(8)+DELT(6,8)
IJ=417
GO TO 850
417 ANP=ANS5
YXS(8)=X(8)-DELT(6,8)
IJ=418
GO TO 850
418 P(6,8)=(ANP-ANS5)/(2.*DELT(6,8))
YXS(8)=X(8)
-----F(8)-----
SID=SIN(DELT)
C0D=COS(DELT)
CSA=YXS(4)*SID-YXS(7)
CSB=YXS(4)*C0D
DSA=YXS(4)*SID-YXS(3)
DSB=YXS(4)*C0D
CSA2=CSA**2
CSB2=CSB**2
DSA2=DSA**2
DSB2=DSB**2
PJ1=YXS(4)*C0D-2.*YXS(7)*SID+C0D
P81=CSA2+CSB2
PU2=YXS(4)*C0D-2.*YXS(8)*SID+C0D
P82=DSA2+DSB2
RCRD=SQR((CSA2+CSB2)/(DSA2+DSB2))
ACD=ALOG(RCRD)
SITC=ATAN(CSB/CSA)
SITD=ATAN(DSB/DSA)
IF (SITD<=T.0.) SITD=PAI+SITD
SCD=SITC-SITD
P(8)=-(C0D*ACD+SID*SCD)/PAI-SIN(ALFA1-YXS(5))/COS(YXS(5)+GAMMA)
P(8,1)=0.
P(8,2)=0.
P(8,3)=0.
P(8,4)=(PJ1/P81-PU2/P82)/PAI
P(8,5)=-COS(ALFA1+GAMMA)/COS(YXS(5)+GAMMA)**2
P(8,6)=0.
P(8,7)=YXS(7)*COS(DELT)/(PAI*(CSA2+CSB2))
P(8,8)=-YXS(8)*COS(DELT)/(PAI*(DSA2+DSB2))

```

```

NCAV1=NCAV+1
33 253 ICV=1,NCAV1,2
253 WRITE(6,252) CAVX(ICV),CAVY(ICV)
252 FORMAT(10X,*CAVX=*,F10.5*5X,*CAVY=*,F10.5)
33 129 ITX=1,8
129 WRITE(6,131) ITX,=(ITX)
131 FORMAT(1X,24F(,I1,24)=,E14.7)
DO 132 IUP=1,8
132 WRITE(6,133) IUP,(P(IJ),JUP),JUP=1,8)
133 FORMAT(1X,2HP(,I1,44,J)=,8(E13.6,1X))
335 CONTINUE
CALL DETERM(P,8,DET30)
DO 25 IDET=1,8
33 26 LPG=1,8
Q(LPG,IDE)=P(LPG,IDE)
25 P(LPG,IDE)=F(LPG)
CALL DETERM(P,8,DET3)
IF(IDE=EQ.1) DEL3=DETE/DET30
IF(IDE=EQ.2) DELC=DETE/DET30
IF(IDE=EQ.3) DELD=DETE/DET30
IF(IDE=EQ.4) DELE=DETE/DET30
IF(IDE=EQ.5) DELF=DETE/DET30
IF(IDE=EQ.6) DELG=DETE/DET30
IF(IDE=EQ.7) DELH=DETE/DET30
IF(IDE=EQ.8) DELI=DETE/DET30
33 27 LPG=1,8
27 P(LPG,IDE)=Q(LPG,IDE)
25 CONTINUE
X(1)=X(1)+DELB
X(2)=X(2)+DELC
X(3)=X(3)+DELD
X(4)=X(4)+DELE
X(5)=X(5)+DELF
X(6)=X(6)+DELG
X(7)=X(7)+DELH
X(8)=X(8)+DELI
33 50 LMN=1,8
50 WRITE(6,61) LMN,X(LMN)
51 FORMAT(1X,24X(,I1,24)=,E14.7)
A3SB=A3S(DELB/X(1))
A3SC=A3S(DELC/X(2))
A3SD=A3S(DELD/X(3))
A3SE=A3S(DELE/X(4))
A3SF=A3S(DELF/X(5))
A3SG=A3S(DELG/X(6))
A3SH=A3S(DELH/X(7))
A3SI=A3S(DELI/X(8))
KEIO=0
IF(ABSB.LT.STOL) KEIO=1
IF(ABSC.GT.STOL) KEIO=0
IF(ABSD.GT.STOL) KEIO=0
IF(ABSE.GT.STOL) KEIO=0
IF(ABSF.GT.STOL) KEIO=0
IF(ABSG.GT.STOL) KEIO=0
IF(ABSH.GT.STOL) KEIO=0
IF(ABSI.GT.STOL) KEIO=0
IF(KEIO.EQ.1) GO TO 35
I=I+1
WRITE(6,42) I
*2 FORMAT(20X,14HITERATION NO.=,I2)

```

```

IF(I.EQ.M) GO TO 35
GO TO 55
35 IF(I.EQ.M) GO TO 36
GO TO 38
36 WRITE(6,37)
37 FORMAT(1X,34HDXFNEW DID NOT CONVERGE WITHIN 14T)
IF(X(7).GT.SI7) X(7)=SI7
IF(X(1).LT.SI1) X(1)=SI1
SI10=X(1)*2.*D6
IF(X(2).LT.SI10) X(2)=SI10
SI11=X(2)*2.*D6
IF(X(3).LT.SI11) X(3)=SI11
SI8=X(3)*2.*DELT(3,1)
IF(X(8).LT.SI8) X(8)=SI8
IF(X(5).LE.1.E-3) X(5)=1.E-3
IF(X(4).LT.SI5) X(4)=SI6
SI5=(.5*PAI-GAMMA)*(.1.-.02)
IF(X(5).LT.0.) GO TO 51
IF(X(5).GT.SI5) X(5)=SI5
GO TO 32
51 IF(ABS(X(5)).GT.SI5) X(5)=-SI5
52 CONTINUE
C          )2211,6(ETIRW )+0.EL.)7(X( FI
C          )-----)REZ VAT SSEL EMACEB )7(X-----,X2(TAMROF 2211
53 RETURN
END

```

```

SUBROUTINE DFSIM1(ANS,NDF,XCA)
DIMENSION XST(8)
COMMON YCCC,SBETA2
COMMON XITM(200),XITN(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LP4M,NS2
COMMON AJ(100),ISHARP,VCH3Y,BETAV(100),BBTAV2(100),BETAV2(100)
COMMON FLAPAN,DELTA,DSAP,ALFA1,GAMMA
COMMON SBETA,XK4,ICPI,SARCO(513)
COMMON IDJL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIS,SIGS,SMALS,DSS
COMMON XSV(8),JLE,ERC,YYY,XM,ITERA,SXSIO(8),SXSI0(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARCO(513),LP4,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XRQJVD,A2AA,3238,200
COMMON AAAA,BBBB,CCCC,A8,B8,C8,D8,TGAUS(100),NGAUS(100),NGAUS
COMMON /SPC/ESPACE
      NDF = 0 CALLED FROM F1INT.
      NDF = 1 CALLED FROM RMINT FOR REAL PART.
      NDF = 2 CALLED FROM RMINT FOR IMAG. PART.
      NDF = 3 CALLED FROM CAVITY DFXNEW AT F(5)
      IF (ICPI.EQ.0) GO TO 9
      DO 10 IQ = 1,8
10 XST(IQ) = XSN(IQ)
      GO TO 12
      9 DO 11 IH = 1,8
11 XST(IH) = YXS(IH)
12 CONTINUE
      IF(ITERA.EQ.1) GO TO 222
      GO TO 223
222 DO 224 ILK = 1,LPK
224 BETAN(ILK) = SBETA
223 CONTINUE
      CSPACE = (1.+XST(1))/F_DAT(LPK)
      FSPACE = CSPACE/FLOAT(LPM-LPK)
      LP3=LP4-3
      XBET = -1.+CSPACE*FLOAT(LPK-1)
      XS1=-1.+CSPACE
      BE1 = BETAV(2)
      AP1 = (XS1-XST(2))/((XS1+1.)*(XST(1)-XS1)*(XS1-XST(3)))
      AP1S = SQRT(AP1)
      F3 = BE1*AP1S
      XX1 = XST(4)*SIN(DE_TL)
      YY1 = XST(4)*COS(DELTAL)
      YY12 = YY1**2
      PL4 = XS1-XX1
      PLM2 = PL4**2
      PLMA = PL42*YY12
      PKSR = PL4/PLMA
      PKSI = YY1/PL4
      IF(NDF.EQ.1) F3 = F3*PKSR
      IF(NDF.EQ.2) F3 = F3*PKSI
      IF(NDF.EQ.3) F3=F3/(XS1-XCA)
      ANSA=0.
      DO 1 I = 2,LP3+2
      F1 = F3
      SPACE = CSPACE
      IF (1.GE.LPK) GO TO 30
      XS12 = -1.+SPACE*FLDAT(I)
      XS13 = XS12+SPACE
      GO TO 31
30 SPACE = FSPACE

```

```

XSI2 = XSI2+SPACE=FLDAT(I-LPK+1)
XSI3 = XSI2+SPACE
51 BE2 = BETAN(I+1)
BE3 = BETAN(I+2)
AP2 = (XSI2-XST(2))/((XSI2+1.)*(XST(1)-XSI2)*(XSI2-XST(3)))
AP3 = (XSI3-XST(2))/((XSI3+1.)*(XST(1)-XSI3)*(XSI3-XST(3)))
AP2S = SQRT(AP2)
AP3S = SQRT(AP3)
F2 = BE2*AP2S
F3 = BE3*AP3S
HA2 = XSI2-XX1
HA22 = HA2**2
HB = HA22+YY12
HCR2 = HA2/HB
HCl2 = YY1/HB
HA3 = XSI3-XX1
HA32 = HA3**2
HD=HA32+YY12
HCR3 = HA3/HD
HC13 = YY1/HD
IF (NDF.EQ.1) F2 = F2+HCR2
IF (NDF.EQ.1) F3 = F3*HCR3
IF (NDF.EQ.2) F2 = F2+HCl2
IF (NDF.EQ.2) F3 = F3*HCl3
IF (NDF.EQ.3) F2 = F2/(XSI2-XCA)
IF (NDF.EQ.3) F3 = F3/(XSI3-XCA)
FSUM = (F1+4.*F2+F3)*SPACE/3.
AVSA = AVSA+FSUM
1 CONTINUE
SQ1 = SQRT((-1.-XST(2))/(-1.-XST(3)))
SQ2 = SQRT(XST(1)+1.)
SQ3 = SQRT((XST(1)-XST(2))/(XST(1)-XST(3)))
ANT1 = BETAN(1)*2.*SQRT(FCSPACE)*SQ1/SQ2
ANT2 = BETAN(LPM)*2.*SQRT(FSPACE)*SQ3/SQ2
APLA = -1.-XX1
APLA2 = APLA**2
APL3 = XST(1)-XX1
APL32 = APL3**2
IF (NDF.EQ.1) ANT1 = ANT1*APLA/(APLA2+YY12)
IF (NDF.EQ.2) ANT1 = ANT1*YY1/(APLA2+YY12)
IF (NDF.EQ.3) ANT2 = ANT2*APL3/(APL32+YY12)
IF (NDF.EQ.2) ANT2 = ANT2*YY1/(APL32+YY12)
IF (NDF.EQ.3) ANT1 = ANT1/(-1.-XCA)
IF (NDF.EQ.3) ANT2 = ANT2/(XST(1)-XCA)
AVS = AVSA+ANT1+ANT2
RETURN
END

```

V4

```

SJ8R0JTINE DFSI42(ANS2)
DIMENSION X(3),XIT(3),YY(3),XITC(3),EXU(3),FCN3(3),ST(3)
C9440V YCCC,SBETA2
C9440V XIT4(200),XITV(200),ANS32S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMH,NS2
C9440V AJ(100),ISHAR,P,NCHBY,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON FLAPAN,DELTA,DGAP,ALFA1,GAMMA
C9440V SBETA,XM,ICPI,SARC0(513)
C9440V IDUL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(8),CLE,ERC,YYY,XM,ITERA,SXSIO(8),SXSI00(8),YXS(8)
C9440V PSIZ,L,P,SARC(513),SARC(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
C9440V XR0JVD,A2AA,3233,C2CC
COMMON AAAA,BBBB,CCCC,AB,BB,CB,D8,TGAUS(100),NGAUS(100),NGAUS
C9440V/SPC/ESPACE
DO 13 I6=1,3
13 XST(16)=YXS(16)
PAI=3.141592653
CCC1= ALOG(1.+XST(6))/(2.*PAI)
JJ2=COS(ALFA1+GAMMA)/COS(XST(5)+GAMMA)/ESPACE
XKKK=ALOG(UJ2)
CSPACE=(1.+XST(1))/FLOAT(LPK)
HCSPACE=0.5*CSPACE
FSPACE=CSPACE/FLOAT(LPM-LPK)
HFSPACE=0.5*FSPACE
XBET=-1.+CSPACE+FLOAT(LPK-1)
CDE=COS(DELTA)
SDE=SIN(DELTA)
SA=XST(1)-KST(4)*SDE
SB=XST(4)*CDE
PPP=CDE/(GA**2+GB**2)
FCN3(3)=DGAP*PPP*XST(1)/(PAI*SQRT(1.+XST(6)))
LPKI=LPM-LPK+1
DO 1 IP=1,_PM
IF(IP.EQ.1) GO TO 2
HSPACE=HFSPACE
SPACE=FSPACE
IF(IP.GT.LPKI) GO TO 30
X(1)=XST(1)-SPACE*FLOAT(IP-2)
X(2)=X(1)-HSPACE
X(3)=X(1)-SPACE
GO TO 31
30 HSPACE=HCSPACE
SPACE=CSPACE
X(1)=XBET-SPACE*FLOAT(IP-LPKI-1)
X(2)=X(1)-HSPACE
X(3)=X(1)-SPACE
31 FCN3(1)=FCN3(3)
NK=3
IF(IP.EQ.LPM) NK=2
DO 9 I=2,NK
IF(IJ.EQ.407) GO TO 7
IF(IJ.EQ.408) GO TO 7
IF(IJ.EQ.409) GO TO 7
IF(IJ.EQ.410) GO TO 7
IF(IJ.EQ.23) GO TO 3
GO TO 7
3 IF(I.EQ.2) XIT(2)=XIT4(LPM-IP+1)
IF(I.EQ.3) XIT(3)=XITV(LPM-IP+1)
GO TO 5

```

```

7 CONTINUE
YY(I)=X(I)
C DFSIM3 CALCULATE G1 .
CALL DFSIM3(YY(I),XITC(I),IP,I)
XIT(I)=XITC(I)
IF(IJ.EQ.18) GO TO 6
GO TO 5
5 I=(I.EQ.2) XITM(LPM-IP+1)=XIT(I)
I=(I.EQ.3) XITN(LPM-IP+1)=XIT(I)
5 CONTINUE
EXU(I)=EXP(-XIT(I))
S2=X(I)-XST(4)*SDE
G0=XST(4)*CDE
PA=G0**2+G0**2
D0X=DGAP*X(I)*CDE/(PA*PA)
FCN3(I)=EXU(I)*D0X/JJ2
IF((K(I).LE.0.)) FCN3(I)=-FCN3(I)
8 CONTINUE
C CASE 1 IF FCN3(I) IS ALWAYS POSITIVE.
IF(IP.EQ.-P4) GO TO 20
GO TO 21
20 PPQ=CDE/((-1.-XST(4)*SDE)**2+(XST(4)*CDE)**2)
S3=DGAP*PPQ/PAI
FCN3(3)=FF3
21 SUM=(FCN3(1)+FCN3(2)*4.+FCN3(3))*SPACE/3.
AVS2=AVS2+SJM
IF(IJ.EQ.18) SARC(LP4-IP+1)=AVS2
GO TO 1
2 SARC(-P4)=0.
AVS2=0.
1 CONTINUE
C XITN(LPM)=G1 AT POINT B.
C XINT(I)=G1 AT POINT X=1.
XITV(-P4)=CCCC1-XKKK/PAI
XITV(1)=0.
RETURN
END

```

**

```

SUBROUTINE OFSIM3(Y,XXII,IP,I)
DIMENSION XST(8),FA(200)
COMMON YCCC,SBETA2
COMMON XIT4(200),XITV(200),ANS62S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),IS1AR,BCHBY,BBTAN(100),BBTAV2(100),BETAN2(100)
COMMON FLAPN,DELTA,JGAP,AL=AI,GAMMA
COMMON SBETA,XXM,ICPI,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,E,P,YR,BIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSN(8),CLE,ERC,YYY,XM,ITERA,SXSID(8),SXSIDC(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),JJ(200),XJK
COMMON XRDJND,A2AA,B2BB,C2CC
COMMON AAAA,B3B3,C3CC,A8,B8,C8,D8,T3AJS(100),JGAJS(100),NGAUS
COMMON/SPC/ESPACE
COMMON/TAJ1/JTAJ
COMMON/CVTYL/CAVLEN,BIGS2
COUR INTEGRALS TO BE EVALUATED BEFORE XI IS OBTAINED.
NOTE THAT PREVIOUSLY ONLY ONE SINGULAR INTEGRAL WAS
CALCULATED IN GCASCADE AND CASCADE.
SEE THE NOTE OF TC 3951 FOR FOJR INTEGRALS, OUT OF WHICH
TWO ARE OF SINGULAR TYPE.
IF(ICPI.EQ.0) GO TO 9
DO 11 ISI=1,8
11 XST(ISI)=XSN(ISI)
GO TO 12
9 DO 13 JTJ=1,8
13 XST(JTJ)=YXS(JTJ)
12 PAI=3.141592653
CCC1=ALOG(1.+XST(6))/(2.*PAI)
SSG=SGRT(1.+XST(6))
U2=COS(ALFA1+GAMMA)/COS(XST(5)+GAMMA)/ESPACE
J22=U2**2
J22I=1./U22
TWO=SSG*CAVLEN/J2+(1.-CAVLEN)
TAUW0=ALOG(TWO)
T#1=SGRT(1.-(1.-XST(6)-J22I)*CAVLEN)
TAUW1=ALOG(TW1)
IF (JTAJ.EQ.0) TAJW=TAUW0
IF (JTAJ.EQ.1) TAJW=TAUW1
C-----FIRS I1-----
1F (ITERA.EQ.1) GO TO 50
GO TO 61
50 CONTINUE
51 IZU = 1,LP4
BETAN(IZU) = SBETA
BETAM(IZU) = SBETA
52 CONTINUE
51 CONTINUE
CSPACE=(1.+ XST(1))/FLOAT(LPK)
MCSPACE=0.5*CSPACE
FSPACE=CSPACE/FLOAT(-PM-LPK)
H=SPAC=0.5*FSPACE
X3ET=-1.*CSPACE=FLOAT(-PK-1)
AB2=SQRT(XST(1)+1.)
AB3=SQRT((1.+Y)*(XST(1)-Y))
AB6 = SQRT((XST(3)-Y)/(XST(2)-Y))
AB3 = AB3*AB6
IJ2=LP4-IP+1
IZ3=1

```

```

1=(I.EQ.3) IJ3=-P4-[3+1
I=(I.EQ.0) IU3=IP
BEC=BETAN(IJ3)
IF(I.EQ.2) BEC=BETAM(IU2)
FAA=BEC/A33
LPM1=-34-1
DO 1 IW=2*LPM1
SPACE=CSPACE
IF(IW.GT.LPK) GO TO 45
XSK=-1.+SPACE*FLOAT(ID-1)
GO TO 46
45 SPACE=FSPACE
XSK=XBET+ SPACE*FLOAT(IW-LP)
46 IF(I.EQ.2) GO TO 6
I=(I.EQ.IJ3) GO TO 1
6 FS=SQRT((1.+XSK)*(XST(1)-XSK))
FSA1 = SQRT((XST(3)-SK)/(XST(2)-XSK))
FS = FS+FSA1
FA(IW)=(BETAN(IW)/FS-FAA)/(XSK-Y)
1 CONTINUE
IF(I.EQ.2) GO TO 30
XP1=-1.+MCSPAC
XP2=XP1+CSPACE
XP4=XST(1)-MFSPAC
XP3=XP4-FSPACE
FS1=BETAM(1)/ SQRT((1.+XP1)*(XST(1)-XP1))
FS2=BETAM(2)/ SQRT((1.+XP2)*(XST(1)-XP2))
FS3=BETAM(LPM-2)/ SQRT((1.+XP3)*(XST(1)-XP3))
FS4=BETAM(LPM-1)/ SQRT((1.+XP4)*(XST(1)-XP4))
FSA1 = SQRT((XST(2)-XP1)/(XST(3)-XP1))
FSA2 = SQRT((XST(2)-XP2)/(XST(3)-XP2))
FSA3=SQRT((XST(2)-XP3)/(XST(3)-XP3))
FSA4=SQRT((XST(2)-XP4)/(XST(3)-XP4))
FS1=FS1+FSA1
FS2=FS2+FSA2
FS3=FS3+FSA3
FS4=FS4+FSA4
FP1=(FS1-FAA)/(XP1-Y)
FP2=(FS2-FAA)/(XP2-Y)
FP3=(FS3-FAA)/(XP3-Y)
FP4=(FS4-FAA)/(XP4-Y)
IF(IU3.EQ.2) GO TO 21
IF(IJ3.EQ.LPM1) GO TO 22
IF(IU3.EQ.LPK) GO TO 51
FA(IU3)=0.5*(FA(IJ3-1)+FA(IJ3+1))
GO TO 30
51 BET0=2.*BETAN(LPK)-BETAN(LP<+1)
XOA=XBET-FSPACE
FPW=BET0/SQRT((1.+XOA)*(XST(1)-XOA))
FPA = SQRT((XST(2)-XOA)/(XST(3)-XOA))
FPW=FPWA*FPW
FLP<=FPd-FAA)/(XOA-Y)
FA(IU3)=0.5*(FA(IJ3+1)+FLP<)
GO TO 30
21 FA(IJ3)=(FP1+FP2)/2.
GO TO 30
22 FA(IU3)=(FP3+FP4)/2.
30 XI=0.
LPM3=LPM-3
SPACE=CSPACE

```

```

00 15 JA=2,LPM3,2
I=(JA+GE-2)< SPACE=FSpace
15 XI=XI+(FA(JA)+4.+FA(JA+1)+FA(JA+2))*SPACE/3.
I=(I+2,2) 30 TO 35
XI23=0.5*HCSPAC*(FP1*FA(2))+(FA(LPM-1)+FP4) +0.5*HFSPAC
X<I=41.
<J=39
LPMH=LPM-5
IF(IU3>GE>LPMH) X<I=201.
IF(IU3>GE>LPMH) XU=199
B2Z=(BETAN(1)-BETAN(1))/X<I
B2Y=(BETAN(LPM)-BETAN(LPM1))/X<I
HF=HF*SPAC/XKI
+FH=HCSPAC/XKI
FT3=FP1
=J3=FJ3
XI4=0.
XI1=0.
D0 202 IT4=1,<J+2
FT1=FT3
=J1=FJ3
XM2=XST(1)-HFSPAC+HFF+FLOAT(ITM)
X43=X42+HFF
XT2=-1.+HCSPAC-HF4+F_DAT(ITM)
XT3=XT2-MF4
BETA2=BETAN(LPM1)+B2Y+FLOAT(ITM)
BETA3=BETA2+B0Y
BETT2=BETAN(1)-B02+F_DAT(ITM)
BETT3=BETT2-B0Z
FS2=BETA2/SQRT((1.+X2)*(XST(1)-X42))
FS3=BETA3/SQRT((1.+X43)*(XST(1)-X43))
FV2=BETT2/SQRT((1.+XT2)*(XST(1)-XT2))
FV3=BETT3/SQRT((1.+XT3)*(XST(1)-XT3))
FS2A = SQRT((XST(2)-XM2)/(XST(3)-XM2))
FS3A = SQRT((XST(2)-X43)/(XST(3)-X43))
FV2A = SQRT((XST(2)-XT2)/(XST(3)-XT2))
FV3A = SQRT((XST(2)-XT3)/(XST(3)-XT3))
FS2 = FS2+FS2A
FS3 = FS3+FS3A
FV2 = FV2+FV2A
FV3 = FV3+FV3A
FJ2=(FS2-FAA)/(XM2-Y)
FJ3=(FS3-FAA)/(XM3-Y)
FT2=(FV2-FAA)/(XT2-Y)
FT3=(FV3-FAA)/(XT3-Y)
XI4=XI4+HFF*(FU1+FU2+4.+FU3)/3.
232 XI1=XI1+HF4=(FT1+FT2+4.+FT3)/3.
XA4=BETAN(LPM)+2.*S3RT(HFF)/(AB2*(XST(1)-Y))
XA4A = SQRT((XST(2)-XST(1))/(XST(3)-XST(1)))
XA4 = XA4*XA4A
XI4=XI4+XA4
XA1=BETAN(1)+2.*S3RT(HFF)/(AB2*(-1.-Y))
XA1A = SQRT((XST(2)+1.)/(XST(3)+1.))
XA1 = XA1*XA1A
XI1=XI1+XA1
XI=(XI+XI23+XI1+XI4)*AB3/PAI
XI=XI+BEC* ALOG((XST(1)-Y-HFF)/(1.+Y-HFF))/PAI
XXI1=-XI
33 TO 35
35 XR1=-1.+0.5*HCSPAC

```

```

X2=X1+HCSPAC
X4=xST(1)-0.5*HFSPAC
X3=X4-HFSPAC
FT1=0.5*(BETAN(1)+BETAM(1))/ SQRT((1.+X1)*(xST(1)-X1))
FT2=0.5*(BETA4(1)+BETAN(2))/ SQRT((1.+X2)*(xST(1)-X2))
FT3=0.5*(BETAN(LP4-1)+BETAM(LP4-1))/ SQRT((1.+X3)*(xST(1)-X3))
FT4=0.5*(BETAM(LPM-1)+BETAN(LPM))/ SQRT((1.+X4)*(xST(1)-X4))
FT1A = SQRT((XST(2)-X1)/(xST(3)-X1))
FT2A = SQRT((XST(2)-X2)/(xST(3)-X2))
FT3A = SQRT((XST(2)-X3)/(xST(3)-X3))
FT4A = SQRT((XST(2)-X4)/(xST(3)-X4))
FT1 = FT1+FT1A
FT2 = FT2+FT2A
FT3 = FT3+FT3A
FT4 = FT4+FT4A
FR1=(FT1-FAA)/(X1-Y)
FR2=(FT2-FAA)/(X2-Y)
FR3=(FT3-FAA)/(X3-Y)
FR4=(FT4-FAA)/(X4-Y)
XI1=0.5*HCSPAC*(FR1+FR2)+0.5*HFSPAC*(FR3+FR4)
XI2=0.25*HCSPAC*(FR2+FA(2))+0.25*HFSPAC*(FA(LP4-1)+FR3)
XI23=XI1+XI2
X*I=21.
X4I2=42.
M2=MU-2
LPMA=LP4-5
IF(IU2.GE.LPMA) XMI=101.
IF(IU2.GE.LPMA) XMI2=202.
IF(IU2.GE.LPMA) MU=101
IF(IU2.GE.LPMA) M2=4J-2
BETY=(BETAV(LPM)-BETAV(LP4-1))/XMI2
BESS=0.5*(BETAN(LPM)+BETAM(LPM-1))
HSPS=0.5*HFSPAC/XMI
FQ3=FR4
BETY1=(BETAM(1)-BETAV(1))/X4I2
BESSI=0.5*(BETA4(1)+BETAN(1))
HSPS1=0.5*HCSPAC/XMI
F231=F21
X1=0.
X4=0.
DO 129 IL=1,M2+2
F21=F23
F21=FQ31
X2=xST(1)-HSPS*FLDAT(MU-IL)
X3=X2+HSPS
X21=-1.+HSPS1*FLDAT(MU-IL)
X31=X21-HSPS1
BETA2=BESS+BETY*FLDAT(IL)
BETA3=BESS+BETY*FLDAT(IL+1)
BETA21=BESSI-BETY1-F231*FLDAT(IL)
BETA31=BETA21-BETY1
F21=BETA21/ SQRT((1.+X21)*(xST(1)-X21))
FJ31=BETA31/ SQRT((1.+X31)*(xST(1)-X31))
FJ21A = SQRT((XST(2)-X21)/(xST(3)-X21))
FJ31A = SQRT((XST(2)-X31)/(xST(3)-X31))
FJ21 = FJ21+FJ21A
FJ31 = FJ31+FJ31A
F221=(F21-FAA)/(X21-Y)
F231=(FJ31-FAA)/(X31-Y)

```

```

FU2=BETA2/SQRT((1.+X2)*(XST(1)-X2))
FJ3=BETA3/SQRT((1.+X3)*(XST(1)-X3))
FU2A = SQRT((XST(2)-X2)/(XST(3)-X2))
FJ3A = SQRT((XST(2)-X3)/(XST(3)-X3))
FJ2 = FJ2*FU2A
FU3 = FU3*FU3A
FQ2=(FU2-FAA)/(X2-Y)
FQ3=(FU3-FAA)/(X3-Y)
X1=X1+HSP61*(FQ1+4.*FQ2+FQ3)/3.
129 XI4=XI4+HSP6*(FQ1+4.*FQ2+FQ3)/3.
XIA=2.*SQRT(HSP6)*BETAN(LPM)/(AB2*(XST(1)-Y))
XIAA = SQRT((XST(2)-XST(1))/(XST(3)-XST(1)))
XIA = XIA*XIAA
XI4=XI4*XIA
XIB=2.*SQRT(HSP61)*BETAN(1)/(AB2*(-1.-Y))
XI3A = SQRT((XST(2)+1.)/(XST(3)+1.))
XIB = XIB*XI3A
XI1=XI1+XIB
XI=(XI+XI1+XI2+XI4)*493/PAI
XI=XI+BEC ALOG((XST(1)-Y-HSP6)/(1.+Y-HSP61))/PAI
XXI1=-XI
36 CONTINUE
-----I2-----
-----IF Y IS LESS THAN ZERO, THIS IS A
-----REGULAR INTEGRAL, WHILE Y .GE. 0, THIS IS A
-----SINGULAR INTEGRAL.
C BUT THIS IS TREATED AS A SINGULAR INTEGRAL ANYWAY
ISIC=3
XCA=Y
CAL_ IC2(SR,S4,XCA,ISIC)
K(I2=SR
ARGL=(XST(1)-Y)/Y
IF (ARGL=.T.0.) ARG_=-ARGL
XXI2=XXI2*AB3*ALOG(ARGL)
XXI2=-XXI2
-----I3-----
C JSE CHEBYSHEV-GAUSS QUADRATURE.
C AJ(I) ARE ALREADY CALCULATED IN SUBROUTINE F1INTL
C AND PASSED ONTO HERE BY COMMON STATEMENT.
XXI3 = 0.
BPC5 = (XST(1)+XST(2))*5
CMBS = (XST(2)-XST(1))*5
A31 = (BPC5+1.)/CMBS
A32 = (-BPC5+XST(3))/CMBS
DO 120 ISJ4 = 1,VG3Y
HA1 = 1.-AJ(ISUM)
HA2 = (AJ(ISUM)+A31)*(A32-AJ(ISUM))
SHA2 = SQRT(HA2)
F3I3 = HA1/SHA2
F3AI3 = CMBS*AJ(ISUM)+BPC5-Y
120 XXI3 = XXI3+F3I3/F3AI3
XXI3 = XXI3*PAI/VCH3Y
UU22 = COS(ALFA1+GAMMA)/COS(XST(5)+GAMMA)/ESPACE
C 17(TSX/AMMAG+5(TSX(SOC/A4MAG+1AF_A(SOC = 22UJ
MX3 = CCC1-ALOG(UU22)/PAI
XXI3 = XXI3*AB3*MX3
-----I4-----
C JSE CHEBYSHEV-GAUSS QUADRATURE FORMULA---
C BBETAN2(I) ARE ALREADY CALCULATED IN
C SUBROUTINE F1INTL AND PASSED ONTO HERE BY

```

```

: COMM4DV STATEMENT.
FPC5 = (XST(3)+XST(2))*5
FMC5 = (XST(3)-XST(2))*5
A41 = (FPC5+1.)/FMC5
A42 = (FPC5-XST(1))/FMC5
XXI4 = 0.
DO 130 ISUM = 1,NCHBY
RAX = (BBTAV2(ISUM)+PAI)*(1.+AJ(ISU4))
RBX = (AJ(ISU4)+A41)*(AJ(ISUM)+A42)
SRBX = SQRT(RBX)
RCX = RAX/SRBX
RDX = FMC5*AJ(ISUM)+FPC5-Y
130 XXI4 = XXI4 + RCX/RDX
XXI4 = XXI4*PAI/NCHBY
XXI4 = -XXI4*AB3/PAI
C-----I5-----
GP14=(XST(7)+1.)*5
G411=(XST(7)-1.)*5
A51=(GM1H-XST(2))/(-GP1H)
A52=(G41H-XST(1))/(-GP1H)
A53=(GM1H-XST(3))/(-GP1H)
XXI5=0.
DO 70 ISJM=1,NCHBY
HA1 = -(1.+AJ(ISUM))*(AJ(ISJ4)+A51)
HA2 = -(AJ(ISU4)+A52)*(AJ(ISJ4)+A53)
F5A=SQRT(HA1/HA2)
F5B=(-GP14+AJ(ISJ4)+GM1H)-Y
70 XXI5=XXI5+F5A/F5B
XXI5=PAI*XXI5/NCHBY
C-----I5-----
H4FH=(XST(8)-XST(3))*5
HPF4=(XST(3)+XST(3))*5
A51=(HPFH-XST(2))/H4FH
A52=(HPFH-XST(1))/H4FH
A53=(HPFH-XST(1))/H4FH
XXI5=0.
DO 80 ISJM=1,NCHBY
HA1 = (1.-AJ(ISUM))*(AJ(ISU4)+A61)
HA2 = (AJ(ISU4)+A62)*(AJ(ISJ4)+A63)
F5A=SQRT(HA1/HA2)
F5B=H4FH+AJ(ISU4)+H2F4-Y
80 XXI5=XXI5+F5A/F5B
XXI5=PAI*XXI5/NCHBY
XXII = XXI1+XXI2+XXI3+XXI4+AB3-TAJW*(-XXI5+XXI6)/PAI
IWRIT1=2
IWRIT2=30
IWRIT3=50
IF (IJ.EQ.18.AND.IP.EQ.IWRIT1) WRITE(6,55) XXI1,XXI2,XXI3,XXI4,IP
IF (IJ.EQ.18.AND.IP.EQ.IWRIT2) WRITE(6,55) XXI1,XXI2,XXI3,XXI4,IP
IF (IJ.EQ.18.AND.IP.EQ.IWRIT3) WRITE(6,55) XXI1,XXI2,XXI3,XXI4,IP
55 FJRMAT (10x,----I1,I2,I3,I4) D=(4) ARE----,4(E14.7+2X),2X,
A*IP=*,I4)
RETJRV
END

```

**

```

SUBROUTINE DFSIM5(ANSS)
DIMENSION S2SR(101),S2KER(101),XST(9)
COMMON YCCC,SBETA2
COMMON XITV(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB3,BETAC,XCCC,VCAV,LPM4,NS2
COMMON AJ(100),ISHARP,NCHSY,BBTAN(100),BBTAN2(100),BETAV2(100)
COMMON FLAPAN,DELTA,DGAP,ALFA1+GAMMA
COMMON SBETA,XXM,ICPI,SARCO(513)
COMMON IDJ,XA,XB,XC,TANG,EZ,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSVC(8),CLE,ERC,YYY,XM,ITERA,SXSID(8),SXSID(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARCO(513),LPM,DE
COMMON BETAV(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XCX
COMMON XROJND,A2AA,B2BB,C2CC
COMMON AAAA,B3BB,CCCD,A8,B8,C8,D8,TGAUS(100),GAJS(100),V6AUS
COMMON/SPC/ESPACE
PAI=3.141592654
C THIS SUBROUTINE CALLED FROM DKFVEW.
C JSE SIMPSON'S RULE.
DO 1 I4D = 1,8
1 XST(IM0) = YXS(IM0)
CDE = COS(DELTA)
SDE = SIN(DELTA)
C NS2 SHOULD HAVE A FACTOR OF 4.
C NS2=LPM4=LP2
NS21 = NS2*1
NS2A = NS2-1
S2GAP = (XST(3)-XST(2))/NS2
JJ2 = COS(ALFA1+GAMMA)/COS(XST(5)+GAMMA)/ESPACE
      )7(TSX/AMMAG+5(TSX(SOC/AMMAG+1AFLA(SOC = 2UJ
DO 2 IS2 = 1,NS21
XS2 = XST(2)+S2GAP*(IS2-1)
XK0 = XS2*CDE
XMAS = XS2-XST(4)*SDE
XMAS2 = XMAS**2
ASD = XST(4)*CDE
ASD2 = ASD**2
DWDX = DGAP*X(0/((XMAS2+ASD2)*PAI)
IF (IS2.E1.1) GO TO 3
IF (IS2.E2.NS21) GO TO 4
CALL 32 (XS2,ANSG2,IS2)
C G2 CALCULATES G2 WITH XSI GIVEN.
EG2 = EXP(-ANSG2)
IF (IJ.E3.0) ANSG2S(IS2)=ANSG2
S2KER(IS2) = EG2*DWDX/UU2
GO TO 2
3 CONTINUE
S2KER(1) = DWDX/SQRT(1.+XST(6))
ANSG2S(IS2)= ALOG(SQRT(1.+XST(6))/UU2)
GO TO 2
4 CONTINUE
S2KER(NS21) = DWDX/JJ2
ANSG2S(IS2)=0.
2 CONTINUE
S2SR(1) = 0.
DO 10 JS2 = 1,NS2A,2
10 S2SR(JS2+2) = S2SR(JS2)
1+(S2KER(JS2)+4.*S2KER(JS2+1)+S2KER(JS2+2))*S2GAP/3.
IF (IJ.NE.0) GO TO 40
SARC2(1)=0.
DO 50 ISARC=2,NS2,2

```

```
50 S2SR(ISARC)=.5*(S2SR(ISARC-1)+S2SR(ISARC+1))
DO 30 ISARC=1,NS21
30 SARC2(ISARC)=S2SR(ISARC)
40 CJVTIVJE
ANS5 = S2SR(NS21)
RETJRV
END
```

**

```

SUBROUTINE IC2(SR,SM,XCA,ISIC)
DIMENSION XST(8)
COMMON YCCC,SBETA2
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,KCCC,NCA/LPM4/,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAN(110),BBTAN2(100),BETAN2(100)
COMMON FLAPAN,DELTA,DGAP,A,FA1,GAMMA
COMMON SBETA,((4,ICPI),SARC00(513))
COMMON IDUL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSV(3),CL-E,ERC,YYY,XM,ITERA,SXSIO(8),SXSI0(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAV(513),BETAM(513),IJ+LPK,XII(200),XJJ(200),XDX
COMMON XRDJVD,A2AA,B2BB,C2CC
COMMON AAAA,BBBB,CCCC,A8+B8,C8,D8,TGAUS(100),NGAJS(100),NGAUS
COMMON/SPC/ESPACE
DO 1 IPV = 1,8
1 XST(IPV) = YXS(IPV)
  XX1 = XST(4)*SIN(DELTA)
  YY1 = XST(4)*COS(DELTA)
  YY12 = YY1**2
  ISIC = 0 FOR RMINT
  = 1 IN CAVITY OF OFSLMS FOR F(5) AND IN CAVITY.
  2 CALLED FROM F1INTL FOR F(1).
  3 FOR I2 OF = (4).
SR=0.
SM=0.
B4=XST(1)**5
B4MC=B4-XST(2)
B4P1=B4+1.
B4MF=B4-XST(3)
HPFH=(XST(8)+XST(3))**5
HMFH=(XST(3)-XST(3))**5
G41H=(XST(7)-1.)*5
GP1H=(XST(7)+1.)*5
A51=(G41H-XST(2))/(-GP1H)
A52=(G41H-XST(1))/(-GP1H)
A53=(G41H-XST(3))/(-GP1H)
A51=(HPFH-XST(2))/H4FH
A52=(HPFH-XST(1))/H4FH
A53=(HPFH-XST(3))/H4FH
B11=B4MC/B4
B12=B4P1/B4
B13=B4MF/B4
IF(ISIC.NE.3) GO TO 20
AP1=(XCA+1.)*(XST(1)-XCA)*(XCA-XST(3))
AP2=XCA-XST(2)
APS=SQRT(AP1/AP2)
20 CONTINUE
DO 7 ISUM=1,NCHBY
  RA=(AJ(ISJM)+B11)*(AJ(ISJM)+1.)
  RB=(AJ(ISUM)+B12)*(AJ(ISUM)+B13)
  IF ((ISIC.EQ.-5) RA=(AJ(ISJM)+1.)*(-AJ(ISUM)-A51)
  IF ((ISIC.EQ.-5) RB=(AJ(ISUM)+A52)*(AJ(ISUM)+A53)
  IF ((ISIC.EQ.-5) RA= AJ(ISJM)+A51)*(-AJ(ISJM)+1.)
  IF ((ISIC.EQ.-5) RB=(AJ(ISJM)+A52)*(AJ(ISUM)+A53)
  SAB=SQRT(RA/RB)
  SAC=B4*SQRT(1.-AJ(ISJM)**2)/SAB
  XSIP=B4*AJ(ISUM)+B4
  XPX1=XSIP-XX1
  XPX2=XPX1**2

```

```
RV2=X^PXP2+YY12
RdR=X^PXP/RV2
RdI=YY1/RV2
IF(ISIC.E3=1) RdR=1./(XSIP-XCA)
IF(ISIC.EQ.2) RWR=1.
IF(ISIC.E3=3) RdR=(1.-SAC/APS)/( XSIP-XCA)
IF (ISIC.E3=-5) RWR=1.
IF (ISIC.E3=-5) RWR=1.
SR=SR+SAB*RdR
7 SM=SM+SAB*RI
PAI=3.141592654
SR=SR*PAI/VCHBY
SM=SM*PAI/VCHBY
RETURN
END
```

```

SUBROUTINE FINTL(YINT,KCTR)
DIMENSION XST(8)
COMMON YCCC,SBETA2
COMMON XITV(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAV(100),BBTAV2(100),BETAN2(100)
COMMON FLAPAN,DELTA,DGAP,ALFA1,GAMMA
COMMON SBETA,XX4,ICPI,SARC00(513)
COMMON IDUL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSV(8),CLE,ERC,YYY,XM,ITERA,SXSID(8),SXSID(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XOX
COMMON XRDJND,A2AA,3233,C2CC
COMMON AAAA,BBBB,CCCC,A8,B8,C8,D8,TGAUS(100),NGAUS
COMMON /SPC/ESPACE
SUBROUTINE FINTL CALCULATES THE INTEGRALS IN F(1)
ISHARP = 0 FOR SHARP -E.FDILS.
ISHARP = 1 FOR ROUND-OFF -E.FDILS.
IF FDILS HAVE ROUNDED L-E. CHEBYSHEV-GAUSS
QUADRATJE
QUADRATURE FORMULA CAN NOT BE USED. SINCE BETA
IS NOT A SMOOTH FUNCTION.
NCHBY = NUMBER OF CHEBYSHEV-GAUSS QUADRATURE CONTROL POINTS.
PAI = 3.141592654
IF(ICPI.EQ.0) GO TO 9
DO 70 IQ=1,8
70 XST(IQ) = XSN(IQ)
GO TO 12
9 DO 11 IH = 1,8
11 XST(IH) = YXS(IH)
12 CONTINUE
DN1 = (XST(1)+1.)*.5
DN2 = (XST(1)-1.)*.5
A11 = (DN2-XST(2))/DN1
A12 = (DN2-XST(3))/DN1
BC5 = (XST(1)+XST(2))*.5
CMBS=(XST(2)-XST(1))*.5
A31 = (BC5+1.)/CMBS
A32 = (-BC5+XST(3))/CMBS
FCAS = (XST(3)-XST(2))*.5
FC15 = (XST(3)+XST(2))*.5
A41 = (FC15+1.)/FCAS
A42 = (-FC15-XST(1))/FCAS
SPACE2 = (XST(3)-XST(2))/-344
READ LPMM FOR THE SECOND ARC.
IF((KCTR.LT.2) GO TO 100
IF(IJ.GE.2) GO TO 100
CSPACE = (1.+XST(1))/FDAT(-PK)
FSPACE = CSPACE/FLOAT(LPM-LPK)
IDM = 1
KCHCK = -1.
SPACE=CSPACE
DO 20 IC4BY=1,NCHBY
NCH=NCHBY-ICHBY+1
AJ(IC4BY)=COS((2*NCH-1)*PAI/(2*NCH))
X=DN1*AJ(IC4BY)+DN2
IF(ITERA.EQ.1) GO TO 488
22 IF((KCHCK.LT.0).AND.(X) GO TO 21
IF(IOM.GE.LPK) SPACE = FSPACE
XCHCK = XCHCK+SPACE

```

```

      IOM = IOM+1
      GO TO 22
C  X(KSI EXISTS BTW XSI(IOM-1) AND XSI(IOM)
21 CONTINUE
      IOMA = IOM-1
      BBTAN(ICHBY) = BETAN(IOM)+(BETAN(IOM)-BETAN(IOMA))
      X*(X(KSI-XCHCK)/SPACE
C  BBTAN IS USED FOR CHEBYSHEV-GAUSS INSTEAD OF BETAN.
      GO TO 20
433 BBTAN(ICHBY) = SBETA
C  BETAN FOR ITERA.EQ.1 IS SPECIFIED IN OFSIM1.
      20 CONTINUE
100 CONTINUE
      IF ((KCTRL.EQ.6) GO TO 6
      IF ((KCTRL.EQ.5) GO TO 5
      IF ((KCTRL.EQ.4) GO TO 4
      IF ((KCTRL.EQ.3) GO TO 3
      IF ((KCTRL.EQ.2) GO TO 2
      IF ((KCTRL.EQ.1) GO TO 10
      YINT = 0.
      DO 110 ISUM = 1,NCHBY
      ABC = (AJ(ISUM)+A11)/(AJ(ISUM)+A12)
110 YINT = YINT +BBTAN(ISUM)*SQRT(ABC)
      YINT = YINT*PAI/NCHBY
      GO TO 1000
      10 CONTINUE
C  THIS IS THE CASE OF HANDLING RIVED L. E. .
      NOF = 0
      XCA = 0.
      CALL OFSIM1(YINT,NOF,XCA)
C  XCA IS DUMMY, ONLY USED FOR F(S) INDEXNEW.
      GO TO 1000
      5 CONTINUE
      ISIC=-5
      XCA=0.
      CALL IC2(SR,S4,XCA,ISIC)
      YINT=SR
      GO TO 1000
      6 CONTINUE
      ISIC=-6
      XCA=0.
      CALL IC2(SR,S4,XCA,ISIC)
      YINT=SR
      GO TO 1000
      2 CONTINUE
      XCA=0.
C  XCA IS DUMMY.
      ISIC=2
      CALL IC2(SR,S4,XCA,ISIC)
      YINT=SR
      GO TO 1000
      3 CONTINUE
-----INTEGRAL FOR I3.
C  AJ(V) IS CALCULATED AND STORED
      YINT = 0.
      DO 120 ISUM = 1,NCHBY
      A31 = 1.-AJ(ISUM)
      A32 = (AJ(ISUM)+A31)*(A32-AJ(ISUM))
      S2A32 = SQRT(A32)
      ABC = A31/SQRT(A32)

```

```

120 YINT = YINT+ABC
      YINT = YINT*PAI/NCHBY
      GO TO 1000
C-----INTEGRAL FOR I4
C      SINCE BETAN(N) BTWN TCT AND TET ARE
C      EXPECTED TO BE ALWAYS SMOOTH, USE GAUSS-
C      CHEBYSHEV QUADRATURE FORMULA.
C      AJ(N) IS ALREADY CALCULATED.
C      IF THIS IS THE FIRST CASE FOR BETAN2,
C      USE A CONSTANT FOR BETAN2.
C      BBTA4V2 IS USED FOR CHEVY-GAUSS INSTEAD OF BETAN2.
4  CONTINUE
      IF(ITERA.GE.2) GO TO 150
      IF(IJ.GE.2) GO TO 131
C      SEETA2 MUST BE READ FOR THE FIRST RUN.
      DO 160 ICHBY = 1,NCHBY
130  BBTA4V2 (ICHBY) = SBETA2
      VS21=VS2+1
      DO 125 IOC=1,NS21
135  BBTA4V2 (IOC)=SBETA2
      GO TO 131
150  CONTINUE
      IF(IJ.GE.2) GO TO 131
      IOMM = 1
      XC4CK = XST(2)
      DO 170 ICHBY = 1,NCHBY
      XKSI = FCAS*AJ(ICHBY)+FC15
152  IF(XC4CK.GE.XKSI) GO TO 151
      XC4CK = XC4CK + SPACE2
      ID44 = ID44+1
      GO TO 152
151  CONTINUE
      ID44 = ID44-1
      BBTA4V2 (ICHBY) = BBTA4V2 (ID44)
      1+(BBTA4V2 (IOMM)-BBTA4V2 (ID44))*(XKSI-XC4CK)/SPACE2
      ILM=ICHBY
      XKSI = FCAS*AJ(ILM)+FC15
      WRITE(6,250) ILM,BBTA4V2 (ILM),XKSI
250  FORMAT(15X,*I=*,I3,2X,*BBTA4V2=*,E14.7,2X,*XKSI=*,E14.7)
170  CONTINUE
131  CONTINUE
      YINT = 0.
      DO 190 ISUM = 1,NCHBY
      AB1 = (BBTA4V2 (ISUM)+A41)*(1.+AJ (ISUM))
      AB2 = (AJ (ISUM)+A41)*(AJ (ISUM)+A42)
      SAB2 = SQRT(AB2)
190  YINT = YINT + AB1/SAB2
      YINT = YINT*PAI/VCHBY
1010  CONTINUE
      RETURN
      END

```

**

```

SUBROUTINE G2 (XS2,AG2,IS2)
DIMENSION XST(8),XI21S(200),XI22S(200),XI23S(200),XI24S(200)
COMMON YCCC,SBETA2
COMMON XIT4(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),ISHAR,PCHBY,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON FLAPAN,DELTA,JGAP,ALFA1,GAMMA
COMMON SBETA,XM,ICPI,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,E,P,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(8),CLE,ERC,YYY,M,IFERA,SXSI0(8),SXSI0(8),YXS(8)
COMMON PSI2,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAV(513),IJ,LPK,XII(200),KJJ(200),KDX
COMMON XROUND,A2AA,B2BB,C2CC
COMMON AAAA,BBBB,CCCC,A8,B8,C8,D8,GAUS(100),GAUS(100),NGAUS
COMMON/SPC/ESPACE
COMMON/TAJ1/TAJ1
COMMON/CVTYL/CAVLEN,BIGS2
THIS SUBROUTINE IS CALLED BY DFSIM5.
THIS SUBROUTINE CALCULATES FUNCTION G2(XS2) #4IC4
INCLUDES I21(XS2) TO I24(XS2).
XS2 IS XSI- AG2 IS THE SOLUTION OF INTEGRALS.
DO 1 IGP=1,8
1 XST(IGP)=YXS(IGP)
PAI = 3.141592654
CCC1= ALOG(1.+XST(6))/(2.*PAI)
SSG=SQRT(1.+XST(6))
U2=COS(ALFA1+GAMMA)/COS(XST(5)+GAMMA)/ESPACE
J22=U2**2
U22I=1./U22
T=0=SSG*CAVLEN/J2+(1.-CAVLEN)
TAU=0=ALOG(TW0)
TW1=SQRT(1.-(1.-XST(6)-U22I)*CAVLEN)
TAUW1=ALOG(TW1)
IF (JTAU.EQ.0) TAUW=TAUW0
IF (JTAJ.EQ.1) TAUJ=TAUJ1
IF (IJ.GE.47) GO TO 100
----I21(XS1)----.
THE SAME INTEGRATION AS THAT IN
SUBROUTINE CAVITY FOR GC(XS1)
NDF = 3
CALL DFSIM1(ANS,NDF,XS2)
XI21 = ANS
IF(IJ.EQ.40) XI21S(IS2) = XI21
----I22(XS1)----.
JSE THE SAME SUBROUTINE IC2 AS
USED IN CAVITY WITH ISIC=1.
ISIC=1
CALL IC2(SR,SM,XS2,ISIC)
XI22 = SR
NOTE THAT SM IS DMMY VARIABLE.
IF(IJ.EQ.40) XI22S(IS2) = XI22
----I23(XS1)----.
USE CHEBYCHEV-GAUSS QUADRATURE FORMULA
IN EXACTLY SIMILAR MANNER TO THAT IN
DFSIM3 FOR IC3.
XI23 = 0.
BPC5 = (XST(1)+XST(2))*.5
CMBS5 = (XST(2)-XST(1))*.5
A31 = (BPC5 + 1.)/CMBS5
A32 = (-BPC5 + XST(3))/CMBS5

```

```

DO 2 ISUM = 1,NCHBY
H41 = 1.-AJ(ISUM)
H42 = (AJ(ISUM) + A31)*(A32-AJ(ISUM))
SHA2 = SQRT(HA2)
F3I3 = HA1/SHA2
F3AI3 = C4B5*AJ(ISUM)+FPC5-XS2
2 XI23 = XI23+F3I3/F3AI3
XI23 = XI23*PAI/NCHBY
IF (IJ.EQ.40) XI23S(IS2) = XI23
C----I24-----.
C JSE C4E8Y24EV-GAUSS 3JADRATRE
C FORMULA BY ASSUMING THAT
C THE KERNEL FCN. IS SMCJT4.
HU = (XS2+1.)*(XS2-XST(1))*(XST(3)-XS2)
HV = XS2-XST(2)
HW = SQRT(HU/HV)
FPC5 = (XST(3)+XST(2))*0.5
FMC5 = (XST(3)-XST(2))*0.5
A41 = (FPC5+1.)/FMC5
A42 = (FPC5-XST(1))/FMC5
XI24 = 0.
DO 10 ISUM = 1, NCHBY
TPA1 = AJ(ISUM)+A41
TPA2 = AJ(ISUM)+A42
STP = SQRT(TPA1*TPA2)
F4T = (BETAN2(ISUM)+PAI)*(1.+AJ(ISUM))/STP
33TAN42 IS C4E8Y-GAUSS VERSION FOR BETA ON THE SECOND ARC.
F4A = FMC5*AJ(ISUM)+FPC5-XS2
ST2 = SQRT(1.-AJ(ISUM))*2
F4B = FMC5 *ST2*(32TAN2(IS2 )+PAI)/4W
10 XI24 = XI24+(F4T-F4B)/F4A
XI241 = XI24*PAI/NCHBY
C BETAN2 IS USED FOR SIMPSONS RULE.
XLG = ALOG((XST(3)-XS2)/(XS2-XST(2)))
C IS2 IS TRANSFERRED THROUGH 32-ARGUMENT.
XI242 = XLG*(BETAN2(IS2)+PAI)/4W
XI24 = XI241+XI242
IF(IJ.EQ.40) XI24S(IS2) = XI24
50 TO 101
100 XI21 = XI21S(IS2)
XI22 = XI22S(IS2)
XI23 = XI23S(IS2)
XI24 = XI24S(IS2)
111 XI24 = -XI21/PAI-KI22
XS2B=CCC1-ALOG(COS(A_FA1+GAMMA)/COS(XST(5)+GAMMA)/ESPACE)/PAI
C IAP/))7(TSX/)AMMAG+5(TSX(SDC/AMMAG+1AF_A(SDC(GOLA-1CCC = 32SX
XS2C = XS2B*XI23
XS2D = -XI24/PAI
A62 = (XS2A+XS2C+XS2D)*W4
C---I25-----.
SP1H=(XST(7)+1.)*0.5
GM1H=(XST(7)-1.)*0.5
A51=(GM1H-XST(2))/(-SP1H)
A52=(GM1H-XST(1))/(-SP1H)
A53=(GM1H-XST(3))/(-SP1H)
XS2E=0.
DO 20 ISUM=1,NCHBY
HA1 =-(1.+AJ(ISUM))*(AJ(ISUM)+A51)
HA2 =(AJ(ISUM)+A52)*(AJ(ISUM)+A53)
SH12=SQRT(HA1/HA2)

```

```

MA3=-GP1H*AJ(I SUM)+GM1H-XS2
F5=SH12/MA3
20 XS2E=XS2E+F5
XS2E=AI*XS2E/NCHBY
C---125-----
HMFH=(XST(3)-XST(3))*.5
HPFH=(XST(8)+XST(3))*.5
A61=(4PFH-XST(2))/HMFH
A62=(4PFH+1.)/HMFH
A63=(4PFH-XST(1))/HMFH
XS2F=0.
30 30 ISJM=1,NCHBY
MA1 =(1.-AJ(I SUM))+(AJ(I SUM)+A61)
MA2 =(AJ(ISJM)+A62)*(AJ(ISJM)+A63)
SH12=SGRT(HA1/HA2)
MA3=.4FH*AJ(I SUM)+HF=.4-XS2
FS=SH12/H43
30 XS2F=XS2F+F6
XS2F=PAI*XS2F/NCHBY
AG2=A62*(-XS2E+XS2F)*TAUH*HW/PAI
IF (IJ.EQ.27.AND.IS2.EQ.2) WRITE(6,52) XI21,XI22,XI23,XI24,IS2
IF (IJ.EQ.27.AND.IS2.EQ.10) WRITE(6,52) XI21,XI22,XI23,XI24,IS2
IF (IJ.EQ.27.AND.IS2.EQ.30) WRITE(6,52) XI21,XI22,XI23,XI24,IS2
52 FORMAT(10X,*--I1,I2,I3,I4 )= F(5) 1RE---*,4(E13.7+2X),2X,
A *IS2=*,I4)
RETJRN
END

```

vv

```

SUBROUTINE CAVITY (XCC,YCC)
C THIS SUBROUTINE IS CALLED FROM DXNEW FOR F(5).
DIMENSION CKEX(100),SKEY(100),ANSI1(100),SRI2(100),SIC3I3(100)
DIMENSION SIC4I4(100),XST(8)
DIMENSION CAVXX(100),CAVYY(100)
COMMON YCCC,SBETA2
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETA3,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),IS4R2,YCHBY,BBTAN(100),BTAN2(100),BETAV2(100)
COMMON FLAPAN,DELTA,DSAP,ALFA1,GA4MA
COMMON SBETA,XXH,ICPI,SARC0(513)
COMMON IDJ_,XA,X3,X5,TANG,E,P,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSN(8),CLE,ERC,YYY,XM,ITERA,SXSIO(8),SXSI00(8),YXS(8)
COMMON PSIZ,L9,SARC1(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XRDJD,A2AA,B2BB,C2CC
COMMON AAAA,BBBB,CCCC,AB,BB,CS,DS,TGAJS(100),NGAUS
COMMON/SPC/ESPACE
COMMON/TAJ1/TAJU
COMMON/CVTYL/CAVLEN,BIBS2
C XCCC IS THE CAVITY END POINT CALCULATED IN SUB. CAVITY.
CDEL = COS(CDELTA)
SDEL = SIN(CDELTA)
PAI = 3.141592654
DO 1 LOA=1,8
1 KST(LDA) = YXS(LDA)
SCGM = SQRT(1.+XST(5))
CCCI=ALOG(1.+KST(6))/(2.*PAI)
SSG=SQRT(1.+XST(6))
J2=CCS(ALFA1+GA4MA)/CCS(XST(5)+GA4MA)/ESPACE
J22=U2**2
J22I=1./U22
TWO=SSG*CAVLEN/J2+(1.-CAVLEN)
TAUW0=ALOG(TWO)
TJ1=SQRT(1.-(1.-KST(6)-J22I)*CAVLEN)
TAUW1=ALOG(TW1)
IF (UTAJ.EQ.0) TAJW=TAUW0
IF (UTAJ.EQ.1) TAJW=TAUW1
NCAV=90
VCAV1=NCAV+1
CAVS = (XST(2)-XST(1))/NCAV
C LEAVE THE LAST POINT OF XSI = C SINCE THERE IS A
C SINGULARITY FOR SINGLE SPIRAL VORTEX MODEL.
DO 2 LM = 1,NCAV1
XCA = XST(1) +CAVS*(LM-1)
C REAL PART OF OMEGA = BETA+ PAI.
IF ((LM.EQ.1) GO TO 3
IF ((LM.EQ.NCAV1) GO TO 10
C---- IC1(XSI) CALCULATION, CALLING DFSIM1.
IF (IJ.GE.34) GO TO 75
NDF = 3
CALL DFSIM1(ANS,NDF,XCA)
C ANS IS A SOLUTION FOR IC1(XCI), XCI IS IDENTICAL TO XCA.
IF (IJ.EQ.27) ANSI1(LM) = ANS
GO TO 76
75 ANS = ANSI1(LM)
75 CONTINUE
C---- IC2(XSI) CALCULATION.
IF (IJ.GE.34) GO TO 77
ISIC = 1

```

```

      CALL IC2(SR,SM,XCA,ISIC)
C ONLY SR IS UTILIZED-- SM IS FOR RMINT.
C IF (IJ.EQ.27) SRI2(<_4) = SR
C GO TO 78
C 77 SR = SRI2(KLM)
C    CONTINUE
C-----IC3 (XSI) CALCULATION-- USE CHEBYSHEV-GAUSS
C    QUADRATURE FORMULA.
C    BPC5 = (XST(1)+XST(2))*5
C    CMBS = (XST(2)-XST(1))*5
C    A31 = (9PC5+1.)/CMBS
C    A32 = (-BPC5+XST(3))/CMBS
C    EK1 = XCA-XST(2)
C    EK2 = (XCA+1.)*(XCA-XST(1))*(XCA-XST(3))
C    EK3 = SQRT(EK1/EK2)
C    EF3B = CMBS*EK3
C    IF (IJ.GE.34) GO TO 80
C    SIC3 = 0.
C    DO 5 ISUM = 1,NCHBY
C      EJ1=(AJ(ISJM)+A31)*(A32-AJ(ISJM))
C      SEJ1 = SQRT(EJ1)
C      EF3 = (1.-AJ(ISUM))/SEJ1
C      EF3A = CMBS*AJ(ISUM)*BPC5-XCA
C 5   SIC3 = SIC3+(EF3-EF3B*SQRT(1.-AJ(ISJM)**2))/EF3A
C    SIC3 = SIC3*PAI/NCHBY
C    SIC3 = SIC3+ALOG((XST(2)-XCA)/(XCA-XST(1)))*EK3
C    IF(IJ.EQ.27) SIC3I4(<_4) = SIC3
C    GO TO 81
C 80 SIC3 = SIC3I4(KLM)
C 81 CONTINUE
C-----ICA(XSI)----.
C    JSE CHEBYSHEV-GAUSS QUADRATURE FORMULA
C    IN THE SAME MANNER AS THAT FOR I4 IN
C    DFSI43.
C    IF(IJ.GE.34) GO TO 82
C    FPC5 = (XST(3)+XST(2))*5
C    FMCS = (XST(3)-XST(2))*5
C    A41 = (FPC5+1.)/FMCS
C    A42 = (FPC5-XST(1))/FMCS
C    SIC4 = 0.
C    DO 7 ISJM= 1,NCHBY
C      RA = (B3TAN2(ISUM)+PAI)*(1.+AJ(ISUM))
C      R3 = (AJ(ISJM)+A41)*(AJ(ISJM)+A42)
C      SRB = SQRT(R3)
C      RC = RA/SRB
C      RD = FMCS*AJ(ISJM)+FPC5-XCA
C 7   SIC4 = SIC4+RC/RD
C    SIC4 = SIC4*PAI/NCHBY
C    IF(IJ.EQ.27) SIC4I4(<_4)= SIC4
C    GO TO 83
C 82 SIC4 = SIC4I4(<_4)
C 83 CONTINUE
C    IF (IJ.EQ.27.AND.KL4.EQ.2) WRITE(6,55) ANS,SR,SIC3,SIC4,KLM
C    IF (IJ.EQ.27.AND.KL4.EQ.40) WRITE(6,55) ANS,SR,SIC3,SIC4,KLM
C    IF (IJ.EQ.27.AND.<_4.EQ.30) WRITE(6,55) ANS,SR,SIC3,SIC4,KLM
C 55 FORMAT (1X,---,I1,I2,I3,I4 OF CAVITY ARE----+4(E14.7,2X),2X,
C     A<LM>,I4)
C    IC(XSI) = 1/EK3 ALREADY CALCULATED.
C    WU2 = COS(ALFA1+GAMMA)/COS(XST(5)+GAMMA)/ESPACE
C-----IS-----
```

```

GP1H=(XST(7)+1.)*.5
GM1H=(XST(7)-1.)*.5
A51=(GM1H-XST(2))/(-GP1H)
A52=(GM1H-XST(1))/(-GP1H)
A53=(GM1H-XST(3))/(-GP1H)
SIC5=0.
DO 30 ISJM=1,NCHBY
RA =-(1.+AJ(ISUM))+(AJ(ISUM)+A51)
R3 =(AJ(ISUM)+A52)*(AJ(ISJM)+A53)
SRAB=SIRT(RA/RB)
RC=-GP1H*AJ(ISUM)+GM1H-XCA
F5=SRAB/RC
30 SIC5=SIC5+F5
SIC5=PAI*SIC5/NCHBY
C -----IC6-----
H4FH=(XST(3)-XST(3))*.5
H5FH=(XST(3)+XST(3))*.5
A61=(H4FH-XST(2))/H4FH
A62=(H4FH+1.)/H4FH
A63=(H4FH-XST(1))/H4FH
SIC6=0.
DO 40 ISUM=1,NCHBY
RA =-(1.-AJ(ISUM))+(AJ(ISUM)+A61)
R3 =(AJ(ISJM)+A62)*(AJ(ISJM)+A63)
SRAB=SQRT(RA/RB)
RC=HM=1.*AJ(ISUM)+H4FH-XCA
F6=SRAB/RC
40 SIC6=SIC6+F6
SIC6=PAI*SIC6/NCHBY
GC = (-ANS/PAI-SR+(SCC1-AL03(UU2)/PAI)*SIC3
1-SIC4/PAI)/EK3
GC=GC+TAUd*(-SIC5+SIC6)/PAI/EK3
GO TO 25
3 GC = BETAB+PAI
GO TO 25
10 GC=BETAC+PAI
C BETAB AND BETAC ( BODY ANGLES AT B AND C) MUST BE SPECIFIED IN COMMON.
25 CONTINUE
XXS = XCA*CDEL
YYT = XCA-XST(4)*SDEL
YYT2 = YYT**2
XXJ = XST(4)*CDEL
XXJ2 = XXJ**2
XYB = YYT2+XXJ2
DxDK = DGAZ*XXS/(XYB+PAI)
CGC = COS(GC)
SGC = SIN(GC)
CFC = DxDK/SCGM
CKEX(L_M) = CGC*CFC
SKEY(L_M) = SGC*CFC
2 CONTINUE
CAVXX(1)=0.
CAVYY(1)=0.
DO 15 ICAV=3,NCAV1,2
CAVXX(ICAV) = CAVXX(ICAV-2)+CAVS*(CKEX(ICAV-2)+4.*+
1*CKEX(ICAV-1)*CKEX(ICAV))/3.
15 CAVYY(ICAV) = CAVYY(ICAV-2)
1*CAVS*(SKEY(ICAV-2)+4.*SKEY(ICAV-1)+SKEY(ICAV))/3.
IF(IJ.EQ.27) GO TO 100
GO TO 101

```

```
130 DO 102 ICAV=1,NCAV1+2
      CAVX(ICAV)=CAVXX(ICAV)
132 CAVY(ICAV)=CAVYY(ICAV)
      XCCC=CAVX(NCAV1)
      YCCC=CAVY(NCAV1)
131 CONTINUE
      XCC=CAVXX(NCAV1)
      YCC=CAVYY(NCAV1)
      RETURN
END
```

**

```

SUBROUTINE RMINT (SR,SM,MIQ)
DIMENSION ST(8)
COMMON YCCC,SBETA2
COMMON XIT4(200),XITV(200),ANS32S(200),SARC2(200)
COMMON CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMM,NS2
COMMON AJ(100),ISHAR,PCHBY,BBTAN(100),BETAV2(100),BETAV4(100)
COMMON FLAPAN,DELTA,DGAP,ALFA1,SAMMA
COMMON SBETA,KX4,ICPI,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,E9,YC,YR,JBIGS,KL3IGS,BIGS,SMALS,DSS
COMMON XS(8),CLE,ERC,YYY,XM,ITERA,SXSIO(8),SXSI0(8),YXS(8)
COMMON PSIZ,L9,SARC(513),SARC0(513),LPM,DE
COMMON BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XR0JVD,A2AA,323B,C2C
COMMON AAAA,B3BB,CCCC,A3,B3,C3,TGAUS(100),GAUS(100),NGAUS
COMMON SPC/ESPACE
P4I = 3.141592654
IF (ICPI.EQ.0) GO TO 10
DO 12 I5 = 1,8
12 XST(I5) = XSN(I5)
GO TO 11
10 DO 1 IS = 1,8
1 XST(IS) = YXS(IS)
11 CONTINUE
XX1 = XST(4)*SIN(DELTA)
YY1 = XST(4)*COS(DELTA)
YY12 = YY1**2
CB5 = (XST(2)-XST(1))**.5
BC5 = (XST(1)+XST(2))**.5
A31 = (BC5+1.)/CB5
A32 = (-BC5*XST(3))/CB5
BM15 = (XST(1)-1.)*.5
BP15 = (XST(1)+1.)*.5
A11 = (BM15-XST(2))/BP15
A12 = (BM15-XST(3))/BP15
FPC5 = (XST(3)+XST(2))* .5
FMCS = (XST(3)-XST(2))* .5
GP14=(XST(7)+1.)*.5
GM1H=(XST(7)-1.)*.5
HMFH=(XST(8)-XST(3))* .5
HPFH=(XST(3)+XST(3))* .5
A51=(GM1H-XST(2))/(-GP1H)
A52=(GM1H+XST(1))/(-GP1H)
A53=(GM1H-XST(3))/(-GP1H)
A54=(HPFH+XST(2))/H4=1
A52=(HPFH+1.)/HMFH
A53=(HPFH-XST(1))/H4=1
A41 = (FPC5+1.)/FMCS
A42 = (FPC5-XST(1))/FMCS
IF (MIQ.EQ.5) GO TO 5
IF (MIQ.EQ.4) GO TO 4
IF (MIQ.EQ.3) GO TO 3
IF (MIQ.EQ.2) GO TO 2
: AJ(I) ARE ALREADY CALCULATED IN SJROUTINE
: IF INTLY AND STORED IN COMMON AREA.
SR=0.
SM=0.
DO 20 ISUM = 1,NCHBY
GX1 = 1.-AJ(ISUM)
GY1 = (AJ(ISUM)+A31)*(A32-AJ(ISUM))

```

```

SGY1 = SQRT(GY1)
FF3 = GX1/SGY1
FX1 = C85*AJ(ISUM)+303
FX2 = FX1-XX1
FX22=FX2**2
FX3 = FX22+YY12
FF31 = FX2/FX3
FF32 = YY1/FX3
SR = SR+FF3+FF31
20 S4 = S4+FF3+FF32
SR = SR+PAI/NCHBY
SM = SM+PAI/NCHBY
GO TO 1000
5 CONTINUE
SR=0.
SM=0.
DO 50 ISJM=1,NCHBY
GX1 =-(1.+AJ(ISUM))*(AJ(ISJM)+A51)
GX2 =(AJ(ISJM)*A52)*(AJ(ISJM)+A53)
FF3=SQRT(GX1/GX2)
XSP=-SP1H*AJ(ISUM)+SM1H
X*X1=XSP-XX1
XPX12=XPX1**2
30 T2=XPX12+YY12
FF31=XPX1/30T2
FF32=YY1/30T2
SR=SR+FF3+FF31
50 S4=SM+FF3+FF32
SR=SR+PAI/NCHBY
SM=SM+PAI/NCHBY
GO TO 1000
6 CONTINUE
SR=0.
SM=0.
DO 70 ISJM=1,NCHBY
GX1 =(1.-AJ(ISJM))*(AJ(ISJM)+A61)
GX2 =(AJ(ISUM)*A62)*(AJ(ISJM)+A63)
FF3=SQRT(GX1/GX2)
XSP=MMFH*AJ(ISUM)+4P=4
X*X1=XSP-XX1
XPX12=XPX1**2
30 T2=XPX12+YY12
FF31=XPX1/30T2
FF32=YY1/30T2
SR=SR+FF3+FF31
70 S4=SM+FF3+FF32
SR=SR+PAI/NCHBY
SM=SM+PAI/NCHBY
GO TO 1000
2 CONTINUE
IF (ISHARP.EQ.1) GO TO 100
ISHARP = 1 MEANS THAT THE FOIL HAS ROUNDED ...E.
SO THAT THE SIMPSON'S RULE IS USED.
ISHARP = 0 MEANS THAT THE FOIL HAS SHARP L.E.
SO THAT CEBYSHEV GAUSS FORMULA CAN BE USED AS BELOW.
SR = 0
SM = 0
DO 30 ISUM = 1,NCHBY
ST11 = AJ(ISUM)*A11
ST12 = AJ(ISUM)*A12

```

```

F<1 = BBTAN( ISUM)*SRT( ST11/ST12)
JV1 = BP15*AJ( ISUM)*B15-XX1
UN12 = UN1**2
JV13 = UN12+YY12
FK11 = UN1/UN13
F<12 = YY1/UN13
SR = SR+F<1*FK11
50 SM = SM+FK1*FK12
SR = SR*PAI/NCHBY
SM = SM*PAI/NCHBY
GO TO 1000
100 CONTINUE
C THIS IS THE CASE THAT THE FDI HAS ROUNDED L.E.
VDF = 1
XCA = 0.
CALL DFSIM1(SR,VDF,XCA)
C XCA IS DUMMY----ONLY USED FOR F(5) IN OXFNEW.
VDF=2
CALL DFSIM1(SM,VDF,XCA)
GO TO 1000
3 CONTINUE
C USE CHEBYSHEV-GAUSS FORMULA SINCE BETA
C IN THIS REGION IS SMALL.
C BETAN2 (ISUM) ARE ALREADY CALCULATED AT FINITL.
SR = 0.
SM = 0.
DO 50 ISUM = 1,NCHBY
PSL = (BBTAN2(ISJ1)+PAI)*(1.+AJ(ISJ1))
PSM = (AJ(ISUM)+A41)*(AJ(ISJM)+A42)
SQPSM = SRT(PSM)
FF4 = PSL/SQPSM
PSN = FMC5*AJ(ISJ4)+FC5-XX1
PSN2 = PSN**2
FF41 = PSN/(PSN2+YY12)
FF42 = YY1/(PSN2+YY12)
SR = SR+FF4*FF41
SM = SM+FF4*FF42
50 CONTINUE
SR = SR*PAI/NCHBY
SM = SM*PAI/NCHBY
GO TO 1000
4 CONTINUE
C XCA IS DUMMY, ONLY USED FOR IC2 IN F(5)
XCA = 0.
ISIC = 0
C SUBROUTINE IC2 IS ALSO USED IN F(5).
CALL IC2(SR,SM,XCA,ISIC)
1000 RETRN
END
**
```

AD-A081 832

TETRA TECH INC PASADENA CA
COMPUTER PROGRAMS FOR CALCULATING PARTIALLY CAVITATING BLUNT TR--ETC(U)
JAN 80 S MAEKAWA, O FURUYA
N00014-79-C-0234

F/6 9/2

4

UNCLASSIFIED

TETRAT-TC-3284-02

NL

3 OF 3

40

42001124

END
DATA
FILED
4-80
DTIC

```

SUBROUTINE SHAPE(K,Y,BETA,IS1I2)
COMMON/FRECAV/XFREEC,YFREEC
C3440V/JP>Z/A2AAJ,323BJ,C2CCJ,AAAAJ,8888U,CCCCJ,A8J,88U,C8U,J8U
COMMON YCCC,SBETA2
C3440V XITM(200),XITV(200),ANSG2S(210),SARC2(200)
C3440V CAVX(100),CAVY(100),BETAB,BETAC,XCCC,NCAV,LPMM,NS2
C3440V AJ(100),ISHAR2,VCHBY,BBTAN(110),BBTAN2(100),BETAN2(100)
COMMON FLAPAN,DELTA,JGAP,AL=A1,GA441
COMMON SBETA,XXM,ICPI,SARC03(313)
C3440V IDJL,XA,X9,XC,TANG,E2,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSN(B),CLE,ERC,YYY,XM,ITERA,SXSIO(8),SXSI00(8),YXS(8)
COMMON PSIZ,L,P,SARC(513),SARC0(513),LP4,DE
COMMON BETAV(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XCK
COMMON XROJND,A2AA,323B,C2CC
C3440V AAAA,63B3,CCCC,A8,33,C8,38,TGAJS(100),JG4JS(100),VGAUS
COMMON/SPC/ESPACE
PAI =3.141592653
X2=X**2
X3=X**3
XS=SQRT(X)
XH=X*XS
XFREE2=XFREEC**2
XFREE3=XFREEC**3
XFREE8=SQRT(XFREEC)
XFREEH=XFREEC*XFREE8
X22=.2**2
X23=.2**3
X2S=SART(.2)
X2H=.2*X2S
X82=.8**2
X83=.8**3
X8S=SQRT(.8)
X8H=X8S*.3

```

C WE MUST CHECK TO SEE IF WE ARE GOING TO CALCULATE THE TOP PART
 C OR THE BOTTOM PART. IF TOP WE TRANSFER TO 2ND HALF OF ROUTINE.
 C IS1I2 = 3 IS USED FOR CALCULATIONS OF UPPER FOIL PROFILE

```

IF(IS1I2.EQ.1) GO TO 30
IF (IS1I2.EQ.3) GO TO 30

IF (X.LE..2) GO TO 15
IF (X.LE..3) GO TO 20
IF (X.GT..8) GO TO 25

15 Y=A2AA*X+323B*X2+C2CC*X3
YDX=A2AA+323B*2.*X+C2CC*3.*X2
BETA=ATAN(YDX)
GO TO 60
20 Y=AAAA*(4./3.*X+8./3.*XH-4.*X2)+8888*X+CCCC*X5
YDX=AAAA*(4./3.*X+8./3.*1.5*XS-8.*X)+8888*5*CCCC/XS
BETA=ATAN(YDX)
GO TO 60
25 Y=A3+33*X+C8*X2+D8*X3
YDX=B3+2.*C8*X+3.*D8*X2
BETA=ATAN(YDX)
GO TO 50

```

C THIS 2ND HALF OF THE ROUTINE IS FOR CALCULATING THE JP²ER HALF

```

30 IF (IS1I2.EQ.3) GO TO 70
IF (X=FREEC.E..2) GJ T0 35
IF (XFREEC.LE..8) GJ T0 50
IF (XFREEC.GT..8) GJ T0 55
70 CONTINUE
L= (X.E..2) GO T0 35
IF (X.E..8) GO T0 50
IF (X.GT..8) GO T0 55

35 IF (IS1I2.EQ.3) GO T0 80
R1=YFREEC-A2AAU*XFREEC-32BBJ*XFREE2-C2CCU*XFREE3
GJ T0 81
30 R1=0.
31 CONTINUE
IF (X.GT..2) GO T0 40
Y=A2AAU*X+32BBJ*X2+C2CCJ*X3+R1
Y0X=A2AAU+2.*82BBU*X+3.*C2CCU*X2
BETA=ATAN(Y0X)-PAI
GJ T0 50
Y2=A2AAU+2.*82BBU*X2+C2CCU*X23+R1
R2=Y2-AAAAJ*(4./3.*2+8./3.*X2H-4.*22)-83BBU*.2-C2CCU*X2S
IF (IS1I2.EQ.3) R2=0.
I=(X.GT..3) GO T0 43
Y=AAAAU*(4./3.*X+8./3.*XH-4.*X2)+83BBU*X+CCCCJ*XS+R2
Y0X=AAAAU*(4./3.*8./3.*1.5*XS-8.*X)+83BBU+.5*CCCCJ/XS
BETA=ATAN(Y0X)-PAI
GJ T0 60
45 Y3=A8J+88J*.8+CBU*X32+DBU*K33+R2
R3=Y3-A8U-88U*.8-CBU*X82-DBJ*X83
IF (IS1I2.E2.3) R3=0.
46 Y=ABU+B8U*X+CBU*X2+DBU*X3+R3
Y0X=B8J+2.*CBJ*X+3.*DBJ*X2
BETA =ATAN(Y0X)-PAI
GJ T0 50
50 IF (IS1I2.E2.3) GO T0 90
R2=YFREEC-AAAAU*(4./3.*XFREEC+8./3.*XFREEH-4.*XFREE3)-83BBU*XFREEC
1 -CCCCJ*X=REES
GJ T0 91
30 R2=0.
31 CONTINUE
IF (X.GT..3) GO T0 45
Y=AAAAJ*(4./3.*X+8./3.*XH-4.*X2)+83BBU*X+CCCCJ*XS+R2
Y0X=AAAAU*(4./3.*8./3.*1.5*XS-8.*X)+83BBU+.5*CCCCU/XS
BETA=ATAN(Y0X)-PAI
GJ T0 60
55 IF (IS1I2.E2.3) GO T0 100
R3=YFREEC-A8J-B8J*X=REEC-CBJ*XFREE2-DBJ*XFREE3
GJ T0 101
100 R3=0.
101 CONTINUE
GJ T0 46

50 RETURN
END

```

**

```

SJROUTINE XCYC(XCB,YCB,CX,CY)
C340N/UPPER/A2AAU+323BU+C2CCJ+AAAJ+BBBBU+CCCCJ+ABJ+BBU+CBU+DBU
X<=CX
XK2=X<*2
X<3=X<*3
XKS=SQRT(XK)
X<H=X<*XKS
IP=0
IF (CX.LE..2) GO TO 3
IF (CX.LE..3) GO TO 4
IF (CX.GT..8) GO TO 5
3 F1=A2AAU*X<*B2BBJ*X<2+C2CCJ*X<3
F2=A2AAU*2.*B2BBU*XK*3.+C2CCU*XK2
F3=XK-CX
XK=F1+(F3/F2-CY)
D1=F2
D2=(D1+F3*(2.*B2BBJ*5.+C2CCJ*XK))/D1**2
J1=XK=J1+02
DIV=FXK/D*X<
XK=XK-DIV
IP=IP+1
Z=ABS(DIV/X<)
IF((Z.LE..000001).OR.(IP.EQ.20)) GO TO 6
GO TO 3
4 F1=AAAAAU*(4./3.*XK*3./3.*XK-4.*XK2)+BBBBU*XK+CCCCU*XKS
F2=AAAAAU*(4./3.*8./3.*1.5*X<5.-8.*XK)+BBBBU+CCCCJ*.5/XKS
F3=XK-CX
XK=F1+(F3/F2-CY)
J1=F2
D2=(D1-F3*(AAAAAU*(8./3.*1.5*.5/XKS-3.)-CCCCJ*.5*.5/XKH))/D1**2
J2=XK=D2
DIV=FXK/D*XX
IP=IP+1
Z=ABS(DIV/XX)
IF((Z.LE..000001).OR.(IP.EQ.20)) GO TO 6
GO TO 4
5 F1=A8J+BBU*XK+CBU*X<2+DBU*X<3
F2=38J*2.*CBU*XK*3.+J3J*X<2
F3=XK-CX
XK=F1+(F3/F2-CY)
D1=F2
D2=(D1-F3*(2.*CBU*6.*DBU*X<))/D1**2
J3=XK=J1+02
DIV=FXK/D*XX
XK=XK-DIV
IP=IP+1
Z=ABS(DIV/X<)
IF((Z.LE..000001).OR.(IP.EQ.20)) GO TO 6
GO TO 5
6 XCB=X<
IF (CX.LE..2) YCB=A2AAU*XK+B2BBU*XK2+C2CCU*XK3
IF (CX.LE..8) YCB=AAAJ*(4./3.*XK*8./3.*XK-4.*X<2)+BBBBU*XK
X+CCCCU*XKS
IF (CX.GT..8) YCB=A9J+38U*X<+CBJ*XK2+DBU*XK3
RETURN
END

```

**

```
SJROUTINE ARCS2(S2,{C,YC}  
COMMON/FOILEND/XXDD,YYDD  
C9440V/JP3ER/A2AAJ,323BJ,C2CCJ,AAAAJ,BBBBU,CCCCJ,A8U,B8J,C8U,D8U  
C XXDD IS THE ENDPOINT OF THE UPPER FOIL OFFSET  
CXDD=XXDD  
XHIGH=0.  
XLOW=0.  
KINCRT=(CXDD-KC)/50.  
I= (XINCRT.LE.0.) XINCRT=-XINCRT  
IS1I2#1  
S2=0.  
DO 24 IINC=1,50  
XLOW=XHIGH  
XHIGH=XLOW+XINCRT  
CALL ARCLEV(S,XLOW,XHIGH,IS1I2)  
24 S2=S2+S  
RETJRN  
END
```

```

SUBROUTINE ARCLEN(XSS,XL,XH,IS1I2)
C3440V YCCC,S3ETA2
COMMON XITM(200),XITN(200),ANSG2S(200),SARC2(200)
C3440V CAVX(100),CAVY(100),BETAG,BETAC,XCCC,NCAV,LPM4,NS2
C3440V AJ(100),ISHAR,P,NCHBY,BBTAN(100),BBTAV2(100),BETAV2(100)
COMMON FLAPAN,DELTAP,DSAP,AL=AI,SA4MA
C3440V SBETA,KK4,ICPI,SARC0J(513)
COMMON IDUL,XA,XB,XC,TANG,EP,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
C3440V XSV(8),CL-E,ERC,YYY,XH,ITERA,SXSID(8),SXSID0(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARCJ(513),LPM,DE
C3440V BETAN(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XCX
C3440V XRJD,A2AA+323B,C2CC
COMMON AAAA,BBBB,CCCC,A8+B8,C8+D8,TGAUS(100),FGAUS(100),NGAUS
DIMENSION T(100),J(100),F(100)
N=NGAUS
DO 5 J=1,N
  T(J)=TGAUS(J)
5  J(J)=FGAUS(J)
1  SJ4=0.
DO 2 J=1,N
  CALL FC2(T(J),F(J),X-,XH,IS1I2)
2  SUM=SUM+W(J)*F(J)
  XSS=SJ4
  RETURN
END

```

```

SJBRDTINE =C2(T,F,K_,XH,IS1I2)
COMMON/UPPER/A2AAU,B2BBU,C2CCU,AAAAJ,BBBBU,CCCCU,A8U,B8U,C8U,D8U
COMMON YCCC,SBETA2
COMMON XITM(200),XITV(200),ANSG2S(200),SARC2(200)
C344D4 CAVX(100),CAVY(100),BETAB3,BETAC,XCCC,NCAV,LPMH,NS2
COMMON AJ(100),ISHAR>,NCHBY,BBTAN(100),BBTAV2(100),BETAV2(100)
COMMON FLAPAN,DELTA,DGAP,ALFA1,GAMMA
C344D4 SBETA*XK4,ICPI,SARC0(313)
COMMON IDUL,XA,XB,XC,TANG,E*,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XSNC(8),CLE,ERC,YYY,XM,ITERA,SXSIO(8),SXSI0(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAV(513),BETAM(513),IJ,LPK,XII(200),XJJ(200),XDX
COMMON XR3JVD,A2AA,B2BB,C2CC
COMMON AAAA,BBBB,CCCC,A8,B8,C8,D8,TGAUS(100),NGAUS(100),NGAUS
LIC3NT=1
XP=(XH-XL)*T*.5*(XH+XL)*.5
SXP=SQRT(XP)
XP2=XP**2
I=(XP*.3E..3) GO TO 1
I=(XP*.E..2.AND.IIC3NT.E2.1) GO TO 3
IF(XP.LE..2) GO TO 3
P1=(4./3.*4.*SXP-4.*XP)*AAAA
P2=B8BB
P3=.5*CCCC/SXP
I=(IS1I2.EQ.1) P1=(4./3.*4.*SXP-4.*XP)*AAAAU
I=(IS1I2.EQ.1) P2=333BU
I=(IS1I2.E2.1) P3=.5*CCCCU/SXP
GO TO 2
3 P1=-.5*SQRT(2.*XR3JVD)/SXP+A2AA
P2=B2BB*SXP*1.5
P3=2.*C2CC*XP
I=(IS1I2.EQ.1) P1=-.5*SQRT(2.*XR3JVD)/SXP+A2AAJ
I=(IS1I2.EQ.1) P2=3239U*SXP*1.5
I=(IS1I2.E2.1) P3=2.*C2CCJ*XP
GO TO 2
4 CONTINUE
P1=A2AA
P2=2.*3293*XP
P3=3.*C2CC*XP2
I=(IS1I2.EQ.1) P1=A2AAU
I=(IS1I2.E2.1) P2=2.*3233J*XP
I=(IS1I2.EQ.1) P3=3.*C2CCU*XP2
GO TO 2
1 P1=B8
P2=2.*C8*XP
P3=3.*D8*X2
I=(IS1I2.EQ.1) P1=33U
I=(IS1I2.E2.1) P2=2.*C8J*X3
IF((IS1I2.EQ.1) P3=3.*D8U*XP2
2 P4=P1+P2+P3
P42=P4**2
P5=1.*P42
S5=SQRT(P5)
F=(XH-XL)*SP5*.5
RETJRV
END

```

**

```

SUBROUTINE BBBETA(XX,RBETA,IS1I2)
C THIS GIVES BETA(X(XSI)).
COMMON YCCC,BBETA2
COMMON XIT4(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CA/Y(100),CA/Y(100),BETA3,BETAC,XCCC,NCA/,LP44,NS2
COMMON AJ(100),IS4AR2,NCHBY,BBTAN(100),BBTAN2(100),BETAN2(100)
COMMON FLAPAN,DELTAB,JGAP,ALFA1,SA444
COMMON SBETA,XX4,ICPI,SARC0(513)
COMMON IDJL,XA,XB,XC,TANG,E9,YC,YR,JBIGS,XLBIGS,BIGS,SMALS,DSS
COMMON XS(8),E-E,ERC,YY,M,ITERA,SXSID(9),SXSID(8),YXS(8)
COMMON PSIZ,LP,SARC(513),SARC0(513),LPM,DE
COMMON BETAV(513),BETA4(513),IJ,LK,KII(200),KJJ(200),XDX
COMMON XROUND,A2AA,323B,C2CC
COMMON AAAA,B9BB,CCCC,A8,B8,C8,D8,T3AJS(100),GAJS(100),NGAUS
ER1=5.E-3
ER2=5.E-3
I=(IS1I2,E2.1) GO TO 20
C IS1I2=0 FOR S1.
C   1 FJR S2.
C     LPMAA=LPM-1
C     SMALS=SARC(LP)
C     I=(LP,EQ,1) GO TO 10
C     JSS=SARC(1,P)-SARC(LP+1)
C     K_PA=K
C     GO TO 21
20 SMA,S=SARC2(LP)
IF(LP,EQ,1)GO TO 110
X_PA=XX
JSS=SARC2(LP)-SARC2(LP-1)
21 CONTINUE
K1A=XL-2A
* X1B=X1A+.001
CALL FARCFAR,XLPA,X1B,IS1I2)
IF(FAR,LT,0.) GO TO 3
X1A=X1B
GO TO 4
3 CALL 40SEC(X1A,X1B,ER1,ER2,XX,JII,X_PA,IS1I2)
GO TO 11
10 XX=0.
GO TO 11
110 XX=CCCC
11 CAL_S4APE(XX,Y,RBETA,IS1I2)
RETJRN
END

```

```

SJBROUTINE FARC(FAR,XLPA,X13,IS1I2)
COMMON YCCC,SBETA2
C3440V XIT4(200),XITV(200),ANSG2S(200),SARC2(200)
COMMON CAVK(100),CAVY(100),BETAB,BETAC,XCCC,NCA!,LP44,NS2
COMMON AJ(100),ISHARP,NCHBY,BBTAN(100),BBTAN2(100),BETAN2(100)
C3440V FLAPAN,DELTA,JGAP,ALFA1,GA444
COMMON SBETA,KXM,ICPI,SARC00(513)
COMMON IDUL,XA,XB,XC,TANG,E9,V9,Y9,JSIGS,XLBIGS,BIGS,SMALS,DSS
G0440V XS9(8),E9,ERC,YYY,XM,ITERA,SXSIO(8),SXSI00(8),YXS(8)
C3440V PSIZ,LP,SARC(B13),SARC)(513),LPM,DE
C3440V BETAN(513),BETAM(513),IJ,LPK,KII(200),KJJ(200),X3K
COMMON XROUND,A2AA,B2BB,C2CC
C3440V AAAA,BBBB,CCCC,AB,38,C9,38,T3AUS(100),JGAUS(100),NGAUS
IF(XLPA.EQ.X1B) GO TO 1
CALL ARCLEN(XSS,XLPA,X1B,IS1I2)
33 TO 2
1 XSS=0.
2 CONTINUE
FAR=DSS-XSS
RETJRV
END

```

vv

```

SUBROUTINE MOSEC(A,B,ER1,ER2,X,J,XLPA,IS1I2)
J=0
X1=A
X2=B
4 J=J+1
IF(J.GE.800) GO TO 9
CALL FARC(PFX1,XLPA,X1,IS1I2)
CALL FARC(PFX2,XLPA,X2,IS1I2)
X3=X1+(X2-X1)*PFX1/(PFX1-PFX2)
CALL FARC(PFX3,XLPA,X3,IS1I2)
L=(PFX3)1,2,3
1 X2=X3
X1=X1
IF(A-B)10,10,11
10 Y=X3-ER1
IF(Y.LE.0.) Y=0.
GO TO 12
11 Y=X3+ER1
12 CALL FARC(PFY,XLPA,Y,IS1I2)
IF(PFY) 5,2,2
3 X1=X3
X2=X2
IF(A-B) 20,20,21
20 Z=X3+ER1
GO TO 22
21 Z=X3-ER1
22 CALL FARC(PFZ,XLPA,Z,IS1I2)
IF(PFZ) 2,2,3
5 GO TO 4
2 PP=A3S(PFX3)
IF(PP-ER2) 6,6,4
6 X=X3
GO TO 7
9 WRITE(6,9) J
9 FORMAT(1X,2HJ=,I3)
STOP
7 RETJRN
END

```

vv

```
FUNCTION AITKEN(XX,YY,X,N)
DIMENSION XX(1),YY(1),ZZ(21)
I= (N)1,1,2
1 AITKEN=YY(1)
RETJRV
2 IF (N.GT.20) N=20
M=N+1
DO 3 K=1,M
3 ZZ(K)=YY(K)
DO 4 I=1,N
DO 4 J=I,N
4 ZZ(J+1)=ZZ(I)+(X-XX(I))*(ZZ(J+1)-ZZ(I))/(XX(J+1)-XX(I))
AITKEN=ZZ(N+1)
RETJRV
END
```

```

SUBROUTINE DETERM (L,N,D)
C      DETERM REVISED 02-28-73
      REAL M
      DIMENSION A(50,50),SAVEA(50,50)
      IF (N .EQ. 1) GO TO 45
      C = 1.
      VN = N
      DO 9 J = 1,NN
      DO 9 I = 1,NN
      9 SAVEA(I,J) = A(I,J)
      K = 1
      GO TO 13
12   L = L + 1
13   I = K + 1
      - = L
      GO TO 17
15   I = I + 1
17   IF (ABS(SAVEA(I,K)) .GT. ABS(SAVEA(L,K))) L = I
      IF (I .NE. NN) GO TO 15
      IF (L .EQ. K) GO TO 23
      J = K
C      ROW INTERCHANGE
      GO TO 23
22   J = J + 1
23   SAVEA(J) = SAVEA(K,J)
      SAVEA(K,J) = SAVEA(L,J)
      SAVEA(L,J) = SAVEA(J)
      IF (J .NE. NN) GO TO 22
      C = -C
28   I = K + 1
      GO TO 31
30   I = I + 1
31   CONTINUE
      IF (SAVEA(L,L) .EQ. 0.) GO TO 48
      M = SAVEA(I,K) / SAVEA(K,K)
      SAVEA(I,K) = 0.
      J = K + 1
      GO TO 36
35   J = J + 1
36   SAVEA(I,J) = SAVEA(I,J) - M * SAVEA(K,J)
      IF (J .NE. NN) GO TO 35
      IF (I .NE. NN) GO TO 30
      IF (L .NE. (NN-1)) GO TO 12
      D = 1.
      DO 43 I = 1,NN
      J = I
      J = J + SAVEA(I,J)
      IF (ABS(J) == 1.E-36) GO TO 48
43   CONTINUE
      D = D + C
      RETURN
45   J = 4*(1,I)
      RETURN
46   J = 0.
      WRITE (6,51)
51   FORMAT(//5X,TERROR MESSAGE FROM DETERM.T/
1 5X,T MATRIX IS SINGULAR. DETERMINANT SET = 0.0 //)
      RETURN
      END

```

02-20-73

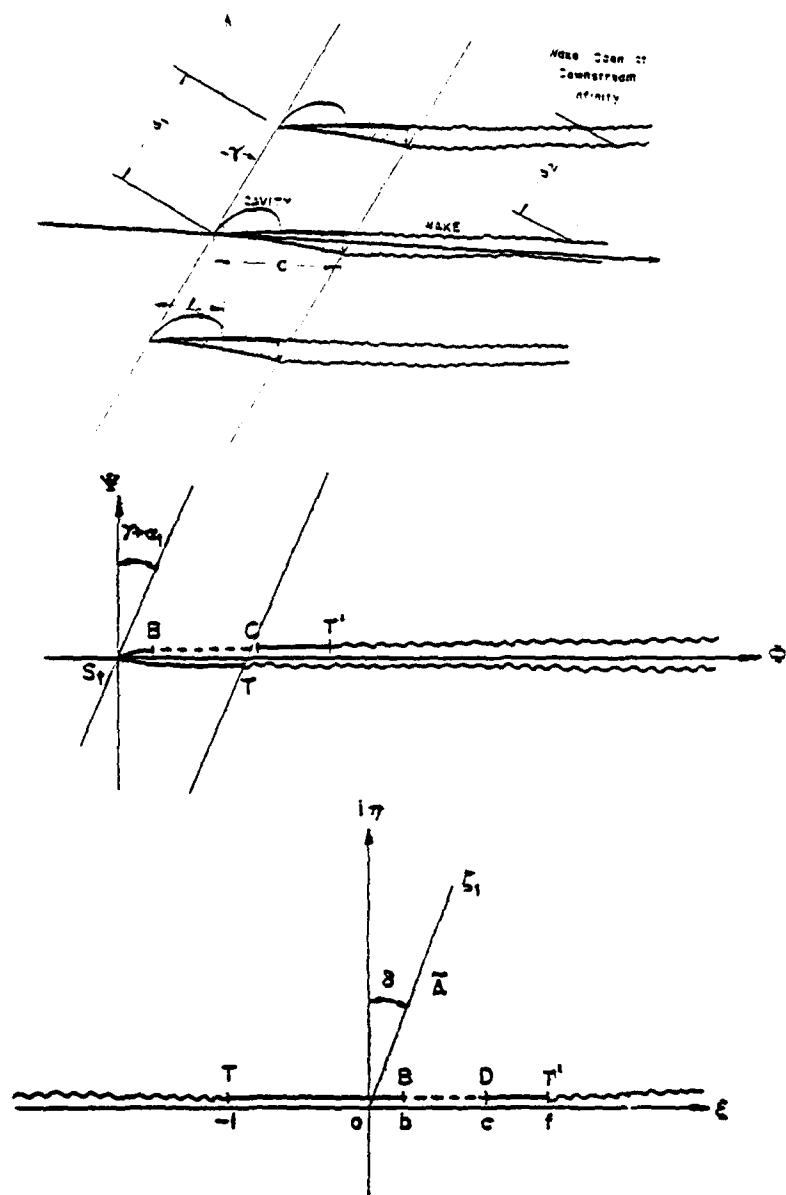


Figure 1 - Open Wake Model for PCASE and PCASLE

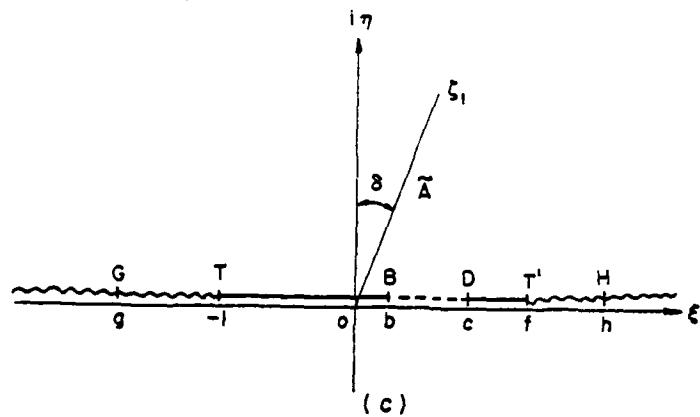
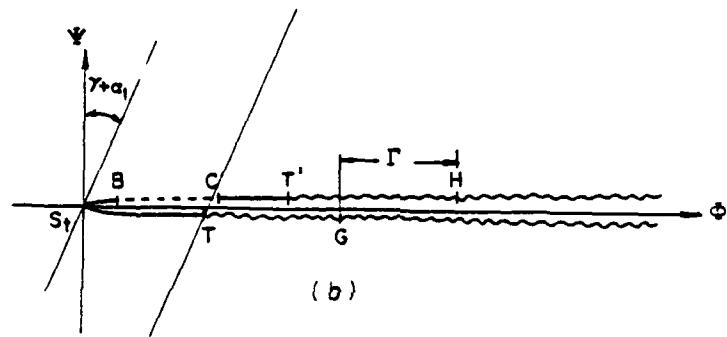
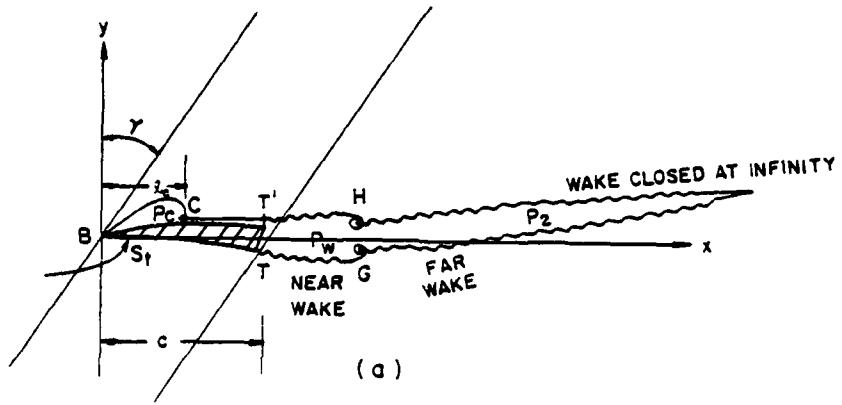


Figure 2 Double Wake Model for PCASLDW

8.0

REFERENCES

1. Furuya, O. and Maekawa, S., 1979, "Partially Cavitating Cascade Theories and Their Application to Cavitating Propeller Flows", Tetra Tech Report TC-3284-01.
2. Furuya, O., July 1978, "Calculations of the Off-Design Performance for Hydronautics SC Propeller (Model No. 7607.02)", Tetra Tech Report TC-3913.
3. Furuya, O., January 1979, "Computer Program for Calculating Partially Cavitating Cascade Flows in Nonlinear Theory", Tetra Tech Report TC-3951-02.